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...HIS UNCLE'S GUILTY PAST . . . by Timmins



FORTUNATELY, I COULD GET LIFEBOUY EVEN IN THOSE DAYS. I DIDN'T TAKE ANY MORE CHANCES AFTER THAT.

THOUGH SAID, UNCLE? I'M GETTING LIFEBOUY NOW!

"B.O. GONE..." Uncle prepares to say—
"BLESS YOU, MY CHILDREN"

LOOKS LIKE I'LL BE HAVING A NEW NIECE SOON. I THOUGHT GRACE WOULD TAKE HIM AFTER LIFEBOUY PUT AN END TO THAT "B.O."

"B.O." has ALWAYS been an unforgivable fault!

IN LOVE—in social or business relations—"B.O." (body odor) is a handicap no one can afford to risk! It's easy to offend unknowingly, for pores give off a quart of odor-causing waste daily. Warmer weather makes us perspire even more freely—increases "B.O." danger. Play safe—bathe regularly with Lifebuoy. Its clean, fresh, quickly-vanishing scent tells you Lifebuoy is different from ordinary toilet soaps—gives extra protection. Its rich, penetrating lather purifies and deodorizes pores—stops "B.O."

Dull skins freshen
Make Lifebuoy your complexion soap—watch your skin improve! For Lifebuoy deep-cleanses—its creamy, searching lather rids pores of clogged impurities—makes dull complexions glow with health.

A PRODUCT OF LEVER BROTHERS CO.

He learned about shaving from her! by J.F. HART



Use this extra-moist lather that soaks beards soft—soothes skin

Holds 52% more moisture

FOR a clean, snappy, long-lasting shave—there's nothing like Lifebuoy Shaving Cream. Because it holds 52% more moisture, Lifebuoy lather does what ordinary thin, quick-drying lathers never can do. It makes stubborn stubble soft—extra soft.

Tough whiskers come off quicker, cleaner, easier. It's kind to the skin, too—leaves it soft, relaxed, refreshed. Try it. Get the big cheerful red tube at your druggist's. Or write to Lever Bros. Co., Dept. A-146, Cambridge, Mass., for a free trial tube. (This offer good in U.S. and Canada only.)

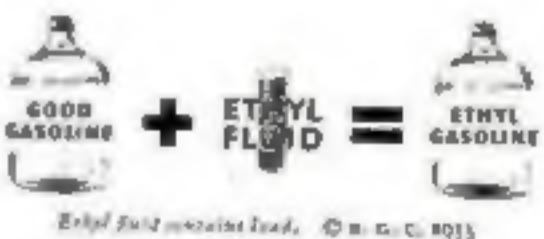


YEP-IT'S BAD NEWS-
BUT YOU CAN'T SAY
I DIDN'T WARN YOU!

WHEN you're running about thirty miles an hour these pistons are flying up and down a couple of thousand times a minute. Think about how fast that is and then you see that if they get smacked on the nose every time, sooner or later you run into trouble.

"Most people don't realize just how much damage knocking gasoline can do to a car. That's why I told you that you better use Ethyl Gasoline last time you were in. Remember?

"It's your car and your money — but after we get this job fixed, *take my advice* and use Ethyl. It's cheaper in the long run, and what's more, you'd be surprised to see how much more life it gives to an older car." *The next best thing to a brand-new car is Ethyl in the tank of your present car.* Ethyl Gasoline Corporation, New York City.



NEXT TIME STOP AT THE

ETHYL PUMP

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ARTHUR WAKELING, Home Workshop Editor
ALDEN P. ARMAGNAC, Associate Editor
SYDNEY OXBERY, Art Editor

POPULAR SCIENCE

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In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions

How to SIMONIZ Your Car!



TO REMOVE GRIME, DISCOLORATIONS AND DULLNESS ALWAYS USE THE WONDERFUL SIMONIZ KLEENER. Nothing could be swifter or safer! No hard rubbing! Just a few easy strokes restores the lustre to the finish and makes your car look new again.



TO KEEP YOUR CAR BEAUTIFUL FOR YEARS PROTECT THE FINISH WITH SIMONIZ. Made to withstand all conditions of weather and climate! Lasting! Simply applied with a cloth! Simoniz keeps injurious elements from getting at the finish to dull and destroy it. Protects the finish, positively makes it last longer and keeps the colors from fading.



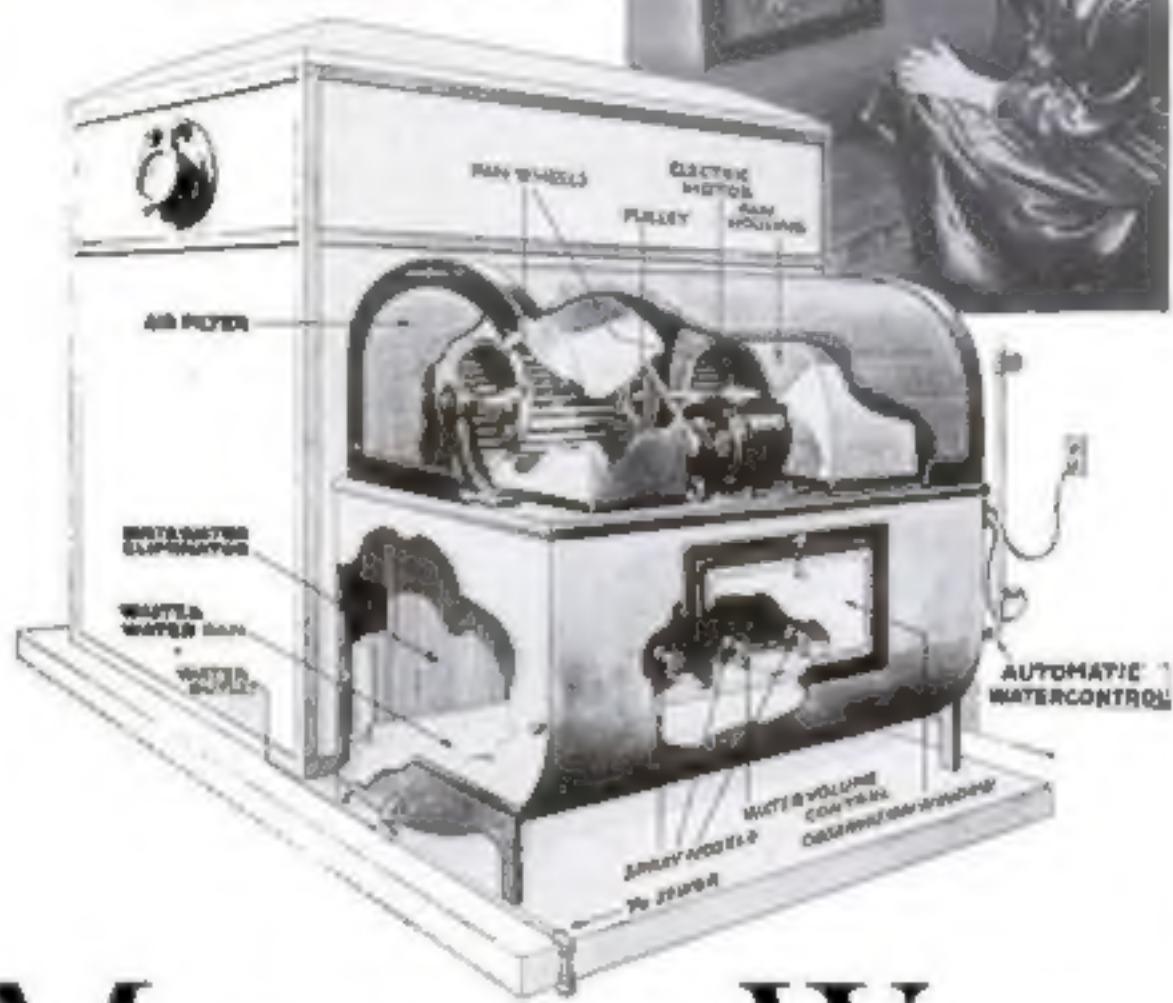
ALWAYS BEAUTIFUL WITHOUT BOTHER OR EXPENSE. Dust and dirt wipe off easily from the Simonized finish with a dry cloth. Washing is rarely, if ever, necessary. Think, in a few seconds you can always have a car that sparkles like new. So Simonize your car, and do it right away, too!

Always insist on Simoniz and Simoniz Kleener! Sold at hardware and auto accessory stores everywhere.

MOTORISTS WISE • SIMONIZ

By R. M. BOLEN
Secretary Popular Science Institute

In the weather maker, right, air is passed through a copper mesh filter and then mixed with a fine whirling water spray. Dust and impurities are thus removed and moisture added to the air. Below, drawing shows details of an air-conditioner which is attached to the rear of a warm air heater



Manufactured Weather FOR THE HOME

WHEN he built his first fire, primitive man made the world's first air conditioner. The warmth of its bright yellow glow provided comfort from the chilling evening winds.

Today, air conditioning is a far broader term. It means more than merely heating the air when it is cold. Science has found that other factors are essential to comfort in summer as well as winter. Air must be cooled if it is hot, dried if it is too wet, wetted if it is too dry, cleaned if it is dirty, and circulated to insure even temperature.

The importance of each of these items, of course, depends on conditions. There is little need for heating in the sultry tropics. Cooling, on the other hand, is useless in the cold climates of the north. Likewise, cleaning, while essential in the dusty cities, is of little value in the country.

Modern methods of air conditioning are elastic processes. They can be altered to meet requirements and carefully designed and tested equipment is available

for every need of the home or factory.

Years ago, Mark Twain said, "Although everybody talks about the weather, nobody does anything about it." But Mark Twain was born fifty years too soon. Today, air conditioning equipment can supply manufactured weather to the home as well as the motion picture palace and the industrial plant.

In the modern sense, air conditioning consists of four important processes—temperature control, humidity control, circulation, and cleaning. Each factor adds to the air in homes and public buildings qualities that are important to health and comfort.

Air heated artificially loses moisture. This moisture must be supplied to create the proper balance. In summer, the air contains too much moisture. This must be removed for comfort's sake. Air conditioners solve both of these problems automatically, and circulate, temper, and filter the air as well.

To the owner of a home equipped with a warm air furnace, science offers all sorts of air con-

MANUFACTUREDWEATHER FOR THE HOME

(Continued from page 4)

ditioning devices. Some do a complete job, others merely supply one or two of the four air conditioning requisites. Individual blowers, automatic humidifiers, and air filters can be attached easily to existing warm air furnaces, or a complete system that washes, tempers, wets or dries, and circulates the air can be installed to feed conditioned air to the furnace and air ducts.

With some complete auxiliary systems, cooling is obtained from ordinary city water. In localities where the city water is not cold enough or where the summer temperatures are excessive, certain manufacturers have available mechanical refrigerating units that cool the air the desired temperature.

The home heated by steam, vapor, or hot water also can be equipped with air conditioning equipment. As with the warm air systems, the apparatus can be either supplementary or central, complete or partial.

Complete ventilating units can be installed in the windows of any home regardless of the type of heating system in use. Units, no larger than a small radio, can be attached to the window sills to filter and circulate the outside air into the room.

Automatic auxiliary humidifiers for winter use range from attractively designed table units to radiators that provide just the right amount of moisture for any temperature.

Portable room coolers, that chill the air by passing it over a cake of ice, offer an air conditioning unit for summer use that can be wheeled from room to room as required.

But, the home owner asks, how much does air conditioning equipment cost? How do I know that the condition of my house warrants the investment? Like heating systems, the cost of air conditioning equipment varies depending on conditions, the degree of air conditioning desired, locality, and installation. Complete costs vary from a few dollars for a humidifier to be connected to an existing warm air furnace to thousands for a large central plant installation.

For the home owner interested in the possibilities of air conditioning, Popular Science Institute has compiled a ten page bulletin listing the various types of air conditioning equipment available for the home. This will be mailed free to every reader who sends six cents in stamps to cover the mailing charges. In order that all the necessary information may be sent you, please state the size of your house, type of heating system in use and fuel employed, extent to which the house is insulated, and specify what degree of air conditioning you desire.

Now Ready

Two valuable bulletins have been prepared for the readers of POPULAR SCIENCE MONTHLY. One is a new twenty-four-page specification list of the new 1933 radio sets compiled by the Popular Science Institute. It contains full information regarding tubes, prices, wave-lengths, and features. The other, a bulletin on air conditioning, outlines the type of air conditioning equipment now available to the home owner. There is no charge for these bulletins except postage. To cover mailing send 15 cents for the radio bulletin and 6 cents for the air conditioning bulletin. Both bulletins will be mailed to you upon the receipt of 21 cents.

Get Set FOR ANOTHER 10,000 MILES WITH CHAMPION EXTRA RANGE SPARK PLUGS



"Champion National Change Week is your reminder to get set for another 10,000 miles. Just look at these plugs of yours in this Tester as compared to Champion Extra Range Spark Plugs. See how your old plugs flicker and stop sparking. That weak spark means wasted gasoline. That's why it pays to change spark plugs every 10,000 miles. It also insures better performance. Now see how this new Champion stands the gaff. Some difference, eh? See that peculiarly shaped insulator? It's patented and is the reason why Champions have the widest driving range known. It means extra power, extra speed and absolute depend-

ability. You ought to have a set of these new Champions, even if you hadn't gone over 10,000 miles. Okay, it won't take me five minutes to install a set." * Champion Spark Plug Company, Toledo, Ohio; Windsor, Ontario.



CHAMPION
EXTRA-RANGE
SPARK PLUGS

See how these stand the gaff
Compare Extra Range performance. Look for it.

National Change Week May 7 to 14

Our Readers Say



The Fish Just Grow and Grow But Where Do They Come From?

In 1930 my son-in-law, at my request, built a pond in his pasture in the rice district of this state, and stocked it with minnows taken during March from a large rice canal. Just before Christmas, he drained the pond to see how his fish were getting along. To his great surprise, he found he had about 500 big mouth trout from eight to fourteen inches long and about half a wagon-load of drumfish the size of his hand. Spurred by this success, he built a second pond for canal minnows and a third for gold fish which he raises and sells for bait. This experience convinces me that any one can have plenty of fish for his own use if he will follow my son-in-law's example. One thing I do not understand is how the millions of fish that grow every year in the rice canals get there. The water in these canals is pumped in from wells but when the canals are drained the ditches are lined with the little fish. Where do they come from?—M. S. B., Shreveport, La.



Here's One Who Wants His Chemistry in Chunks

I SPEAK for both myself and my friends when I say that your magazine is the best science magazine published, but we would like to see more and more chemistry. Several people I know have started chemical laboratories because of the interest stimulated by your chemistry articles. Don't let Mr. Hall stop his articles on the microscope. Every one of his pieces carries valuable information.—G. A. Murray, Inc.

Your Hydrogen Atoms Were Left Undisturbed

In reply to the question of S. B. M., of Des Moines, Ia., as to what happened to his two parts of hydrogen, I want to say that nothing happened to them because nothing was done to separate the oxygen atoms from the hydrogen atoms in the water. The iron nail in the process of oxidation combined with the oxygen that was dissolved in the water and not the oxygen that constitutes the water. Therefore, no hydrogen atoms were released. The oxygen that makes up the water is not utilized because iron does not decompose water at ordinary temperatures. The only substances that will decompose water at ordinary temperatures are sodium, potassium and calcium upon the application of heat. If the nail were plated in distilled water, oxidation would not take place because the oxygen was driven off by distillation.—L. D., Brooklyn, N. Y.



What's 10,000,000 Years to an Innocent Gallifly?

ANSWERED the "mean little question" asked by M. J. M., of Yonkers, N. Y., in a recent issue of your magazine. I should like to say: The gallifly belongs to the phylum Arthropoda, of which there are about 400,000 species. The first traces of these animals are found in the Cambrian period which is dated at least 500,000 years ago. Three-toed horse fossils have been found in the rock of the Oligocene which was from thirty to forty million years ago. During the intervening period of about 470,000,000 years the arthropods had a long time in which to develop. As a result they became highly diversified and specialized. Hence there is little or no noticeable change between the fossils of 10,000,000 years ago and the descendants living today. This should clear up the problem raised in the letter by M. J. M.—R. M. L., Evanston, Ill.

Is There Any Way of Making This Water Do as Bid?

MANY years ago I tried to pull water from a lower level than the level of water in a large bell-shaped tank having an open bottom with a hose going to a small tank, as is shown in the drawing. All air was excluded and both the bell-shaped tank and the hose were sealed against any air getting in. Let us estimate the weight of water in the bell-shaped tank at 2,000 pounds and the weight of water in the hose at fifty pounds. With this big difference in weight, wouldn't you think the water in the bell-shaped tank would quickly suck the water out of the small tank? Well, it won't. As I have always been a solid bone from the jaw up, I have never been able to find out why it won't. I did discover, by this experiment, that I could make water flow in either direction in the hose by raising or lowering the small tank. But that, of course, is merely the siphon principle and as odd as the hills. What got my goat was that the heavier weight did not effect the lighter weight. Now, then, will some one please tell me why it didn't? —J. C. H., Hart, Mich.

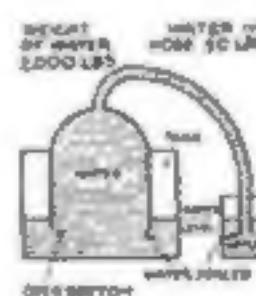
Explicit Directions for Making Rainbow Sign

THE question of G. F. M., Mariners Harbor, N. Y., in Our Readers Say recalled to mind instructions I once read for making a rainbow sign. I believe the changing light feature would readily apply to his proposed aquarium and flower stand. The materials required are three light sockets arranged in a circle or cluster and wired in multiple, three flasher buttons which are sold by most electrical stores at about thirty cents each, and three bulbs, one each of the three pri-

mary colors red, blue, and yellow. One of the flasher buttons is slipped into each socket before the bulbs are screwed in, and as the flashers work independently, various combinations of bulbs will be in action at different times according to your color scheme.—W. G. W., Martins Ferry, Ohio.

All the World Needs a Cop to Keep it on the Jump

I BELIEVE that world conditions demand an international police system. Although subordinate to the League of Nations, such a system would have more power than the League now has and would increase the prestige of the League throughout the civilized world. There would be no such thing as extradition because the authority of the world police would be greater than that of any one nation since it would represent all nations. I should like it known that I suggest the formation of this police system to carry out the decrees of the world court, to protect international trade, and to try at least, to make the world safe for humanity.—S. N. P., Niagara Falls, N. Y.



This Is a Public Fight So Anyone Can Get In

THIS problem has caused a heated dispute and I would appreciate it if one of your readers could tell me the exact truth: "A" claims that solder will not erupt from a pot of molten metal unless water or some other object is thrown into the pot, thus knowingly causing it to erupt. "B" claims that solder will erupt from a pot of molten metal as the result of a chemical reaction taking place when the pot is taken off the fire for a few minutes and then put back on the heat. He also claims that sweating in extreme cold will result in such an eruption. Will some reader please answer this as soon as possible and so end the scrap?—A. M. L., Brooklyn, N. Y.

Couple of Easy Fellows for Sharks at Geometry

PLEAS publish something about the common practice and kinds of mechanical drawing, as it is a universal language and should have a wide appeal. Here are two problems in geometry that I wish you would submit to your readers: How do you find the area of the letter (N) when it is six inches high and four inches wide, having all its bars one inch in width? What are the diameters of two concentric circles that



are five inches apart, the circumference of the smaller circle being three-fifths of the larger one? These two brain teasers have occupied me for a long time but I am sure many readers will have no trouble in dashing them off and easing my suspense. I shall be relieved when I have their solutions.—G. H., Lohville, Ia.

He Uses a Jawbone to Flog the Evolution Critics

In Our Readers Say, I see that C. C. J., of Nanticoke, Pa., claims that evolutionists have no proof that man descended from a mammal and that the entire theory of evolution is guesswork. As a matter of fact, scientists have definite proof that man descended from a mammal in the series of skulls and jawbones dating back to far more than 100,000 years. Everyone who has read the *Origin of Life* and dozens of other books on evolution knows that complete and flawless records exist in the fossils of horses, dogs, and other animals which clearly show the gradual development of these animals. Man has been in existence for at least 100,000 years and a great deal of change and development has taken place during that time. Still living are the aborigines of Australia and the pygmies of Africa who certainly are lower forms than the highly intellectual Negroes. C. C. J. is anxious for man to develop into something new. Just give him a chance. Meanwhile, his present form is not so entirely unsatisfactory.—B. R., Brooklyn, N. Y.



Maybe Wisconsin's Water Is Lighter Than the Rest

Your article in a recent issue about breathing under water through a tube, is wrong. Several years ago, I did this very thing. I breathed through a garden hose connected to a block floating on top of the water. I sat submerged in five feet of water, holding myself down with a stone, and stayed there for five minutes. When I heard the boys tell me the five minutes were up, (which I could hear through the tube in my mouth), I came to the surface. However, my temples were purple with the strain, and I was under the doctor's care for two days. On the other hand, some of the other boys did the same trick under five feet of water for several minutes each. I can furnish witness to prove the above statement, and I can also do the trick again at any time before any audience, and prove this can be done.—O. M. M., Milwaukee, Wis.

Colored Sand Is Wanted To Set-Off These Fish

I AM interested in raising tropical fish and should like to obtain some information on the care of the tanks for them. I should like to know if there is some way of coloring the sand with some dye that will not injure the fish in any way. I should like to know if vegetable dyes would be satisfactory. I am a reader of POPULAR SCIENCE MONTHLY and I don't believe there is a finer magazine on the market. I should appreciate the information for which I have asked if any of your readers who may be engaged in the delightful, profitable, and at present popular occupation of raising these remarkable tropical fish, can supply it.—D. R. F., Chicago, Ill.



Confusion of Terms Was What Bothered That Spring

In answer to H. J. P.'s question "What happened to the energy stored in the compressed spring?" my answer is: He confuses power to produce with energy that is produced. The compressed spring never had any energy in it. The person compressing the spring put energy into the work of compressing it, and not into the spring itself. Clouds during a storm have the power, under certain conditions, to produce millions of volts of electricity. But energy is produced only when the lightning, or electricity acts. The engineer of a steamship with thousands of horsepower, has the power to propel the ship across the ocean. But the ship will stay at the dock unless energy is produced by starting the engines working. A watch, with spring wound tightly but not running, has no energy in it but the spring has power to produce energy when the watch is started. Hence, the acid destroyed the power of the compressed spring to give forth energy.—C. S. V., Brooklyn, N. Y.

Dear Old Kaleidoscope! Gone, But Not Forgotten

What's become of all the old kaleidoscopes? About forty years ago, no parlor was considered complete without one either on the center table along with the wax fruit and flowers and family album, or over on the whatnot in the corner with the dried starfish, sea horse, and whale's tooth. Oh, yes, you were nearly sure to find the kaleidoscope some place in every well regulated parlor forty years ago. And what a grand excuse it made to sit up close. I haven't seen one since Noah wore knee pants. Where are they? Why not add to your wonderful, and valuable Home Workshop Blueprints or Our Construction Kits, a description of, and how to make, a real old-fashioned kaleidoscope? Not one of those little paper tubes you had to hold in your hand,

but the real thing, mounted on a stand, looking like a young telescope, about four inches in diameter and sixteen inches long, as I remember them.—R. S. W., Elverson, Pa.

This Reader Would Like to Build a Microscope

YORK articles on the use of the microscope have been very interesting and educational. May I suggest that I should like to see directions published for making a microscope? I am aware of the difficulties involved in building such an instrument, but they would only add spice to the undertaking.—C. J. S., Cleveland, Ohio.

Honolulu Praises Our Readers' Tolerance

I HAVE been a constant reader of your magazine for a long time and can truthfully say that it has maintained that interesting and instructive quality which has made it popular with its readers since the magazine was first started. Though I have no particular choice as to the type of articles, I always start looking through the magazine from the Home Workshop. After this I read the other articles. I always get a lot of kick looking at Our Readers Say page. For that reason I leave it to the last. What a study in human nature and men's diversity of thoughts and desires! Some want this, some want that. But I see with a lot of satisfaction that the majority of your

readers are tolerant of the other fellow's likes and dislikes and not inclined to force their own desires upon other people.—R. M. O., Honolulu, T. H.

Here's a Simple Problem for Your Checkerboard

On a common checkerboard arrange the twenty-four men on the playing squares around the edge of the board. When two men adjoin each other diagonally, as on 27 and 32 with a vacant space on one side as at 23, you may jump as from 32 to 23, removing the piece on 27. A red piece may jump either a red or black piece and vice versa. All pieces may jump both forward and backward. As a suggestion, you may jump 27 to 23; 20 to 27; 31 to 24; 28 to 19, and etc. The object of the problem is to jump and remove all but one piece. I have met no one who can do this, although I have been assured that it is possible. Can any of Our Readers help me?—R. A., New York, N. Y.

We Published a Circuit Some Months Ago

PERHAPS you will think I'm crazy, but I am interested in radio control. For instance in a recent issue there is an article telling of a German who built a radio controlled boat. Where could I get information on the subject?—C. H., Mount Vernon, N. Y.

Here, at Last, Are Serious Suggestions for Changes



REFERRING to the suggestions you receive for changes in your magazine, I have a couple I should like to make. Why not publish more about cow feeding and hog calling? And let us have a lot more about freaks. In fact, why publish a paper devoted to general science and leave out so much that might be said about how we all sprang from monkeys? Suddenly growing serious, allow me, Mr. Editor, to remark that I start with the first article in your magazine and leave no page unread until I have finished the last word on the back of the last cover. Then I often start in and read it all again, from the back forward. Not that I have nothing else to read, either. Out of seven magazines and two dailies, I read POPULAR SCIENCE MONTHLY first every time.—W. E. H., Minneapolis, Minn.

Model Railroad Scenery Is What He Now Wants

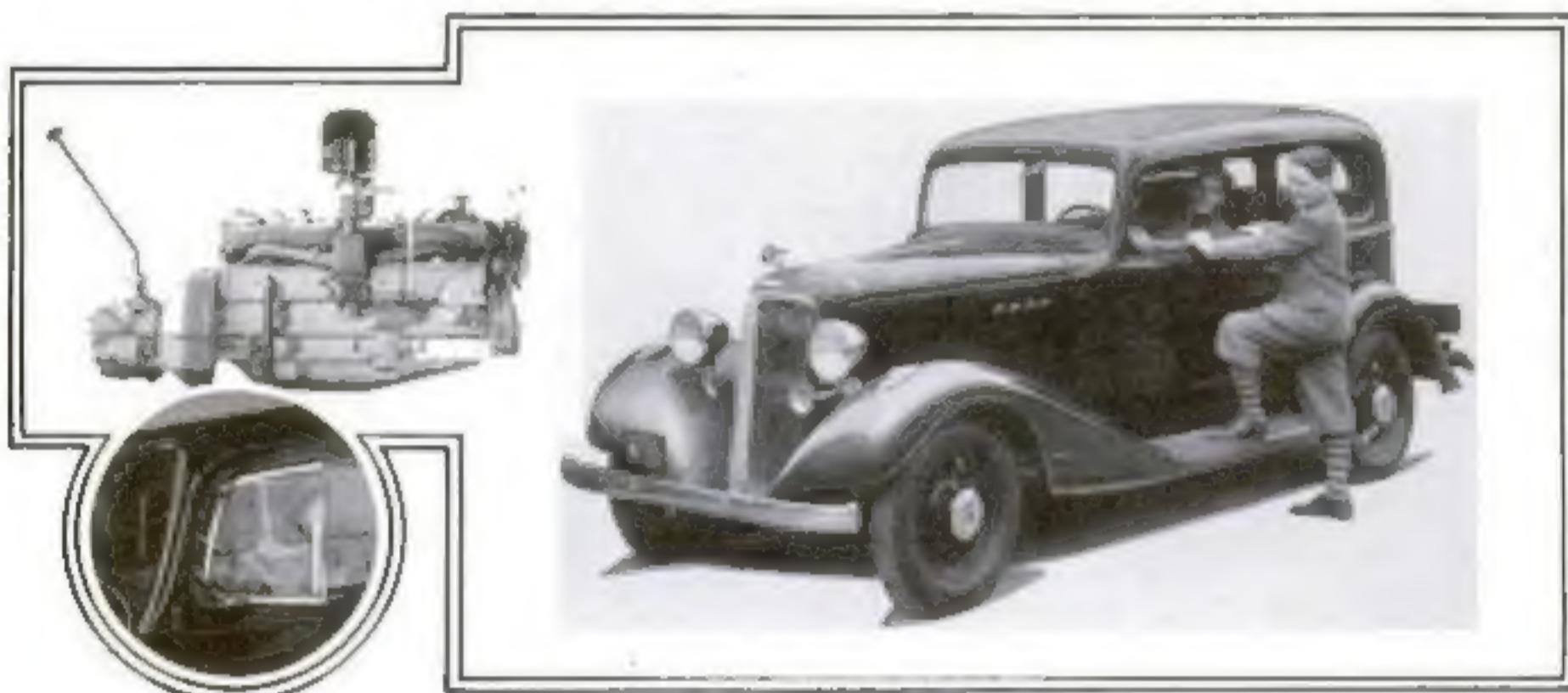
AS AN enthusiastic reader of POPULAR SCIENCE MONTHLY, I am writing to thank you for being of so much help to me in building my model railroad. I have found your articles exceedingly helpful. As yet, I have not tried to make my own engines or cars but I have laid standard track on wooden ties as you recently suggested. What I should like to get now are some hints on scenery. This is the one thing I cannot get to look right. Can you help me? Also I saw in Our Readers Say a letter about lights that will turn red, stop the train; turn green and start the train. I should like to know the how and the why of this if some reader will tell me.—A. W., Haddon Heights, N. J.





Balanced Features *Engineered* and *Built* to give you **BALANCED VALUE**

**APPEARANCE • COMFORT • PERFORMANCE
SAFETY • DURABILITY • ECONOMY**



Modern engineering is so highly developed that it is possible to emphasize any of these characteristics to an abnormal degree, and in this way give a car extraordinary speed, for example. In doing so, however, some other quality or qualities must necessarily be sacrificed. Most cars, therefore, are really engineering compromises, with the emphasis placed upon this or that characteristic as the manufacturing objective demands.

Pontiac is the car of Balanced Value, because it was deliberately designed and built to give you

all the characteristics of a really fine car, so balanced and related to each other that it offers a sum total of car values that is altogether new to the low price field.

Read the Booklet
"What Do You Mean—Balanced Value?"

This little booklet tells the engineering story of Pontiac's Balanced Features in terms of Owner Values. It is free. You can get a copy from the nearest Pontiac dealer—or write direct to Pontiac, Room 15-266, General Motors Bidg., Detroit, Mich. Be sure to read it. It will give you the basis for becoming a more critical judge of motor car character—and a better buyer.

PONTIAC \$585
THE ECONOMY STRAIGHT EIGHT
AND UP TO 100
A.O.B. PONTIAC
EASY CREDIT TERMS
A GENERAL MOTORS VEHICLE



POPULAR SCIENCE

MONTHLY

June 1933

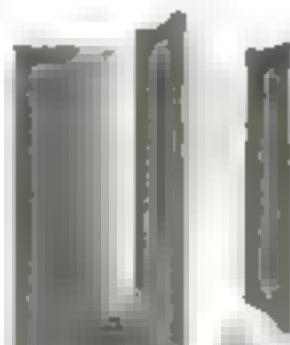
Vol. 122, No. 6

RAYMOND J. BROWN, Editor



HOME OF U. S. EXHIBIT

In this unusual building, with its trio of high towers, will be housed the models showing the work of our scientists in 100 years.



Uncle Sam's Scientists

DISPLAY THEIR CONTRIBUTIONS TO PROGRESS

ACCOMPLISHMENTS of United States Government scientists, during the past one hundred years, will be revealed by impressive exhibits at the Century of Progress exposition which opens at Chicago next month. A building of unusual design decorated in batiste color combinations will house the remarkable display.

No scientific or technical exhibit ever set up exceeded in scope, variety, splendor, and magnitude the continuous performance Uncle Sam will stage in this windowless Federal Building with its trio of sky-painting towers representing the executive, judicial, and legislative branches of our government.

At a time when Washington bureaus and offices are undergoing severe financial curtailment when all costs of government operation are being pruned to the quick, Uncle Sam has to don his formal finery and show his wares. Let no one make the charge that participation in this exposition is a waste of national funds in a time of need. It is, on the contrary, a vindication of the unending and

at Great World's Fair

By GEORGE H. DACY

unavowable costs of government, for the government exhibits demonstrate exactly how the nation pays enormous dividends in its essential services to the general public for the many millions of tax dollars collected annually.

One authority has described the Century of Progress as a symbol of industrial confidence. Although the exposition is be-

ing put on at a time of commercial and financial stress, nine million dollars of the ten millions in bonds to finance the fair have been sold. Financial magic was worked at a time when general prosperity was at low ebb.

The exposition was planned several years ago in celebration of Chicago's one hundredth birthday. Nineteen foreign countries, forty-four states, and the Federal Government accepted invitations to be represented, and despite hard times \$25,000,000 has been spent on the big fair. Chicago hopes to entertain 2,000,000 visitors during the show season from June 1 to November 1, one for each dollar invested in buildings.

One of the most striking of the government exhibits is a colorful reproduction of Mt. Rainier in Mt. Rainier National Park, down whose side past a camping party in miniature, will course a glacier of real ice with a base of living pine and fir trees. The glacier is the product of electrical refrigeration. Tubs of brine sunk beneath the miniature mountain create rough, smooth, and piled-up ice. The top of the mountain and



Real ice, made by electric refrigeration, will form a glacier moving down the side of Mt. Rainier which will be the dominating feature of the Government's Mt. Rainier National Park exhibit

background are painted in oils. An intricate lighting system presents changing cloud effects and a realistic simulation of sunrise, sunset, daylight, and darkness. Motion pictures of vacation and touring scenes in the national parks are shown to the miniature tourists around the campfire in such manner that the spectators also may enjoy them.

The Hoover Dam, greatest engineering feat of its kind, is represented by a faithful working model of dam, power plant, and its related works. It is built on the scale of one inch to thirty feet and is mounted against a diorama, a semi-circular back-drop that gives a realistic impression of a distant stretch of the Colorado River and a section of the surrounding sun-baked mountains of Nevada and Arizona. Water, rushing over the model, combines with shifting light effects to add reality to the spectacle.

Another mechanical exhibit consists of six model groups mounted on an electrically-controlled revolving platform of steel, which represents important stages in our highway development. A miniature stage coach halted at a Colonial inn, models showing the race between the historic Tom Thumb locomotive and a horse, the first primitive wagon-roads of the log cabin era, the bicycle age, the advent of the motor car, the first improved highways, and our best transcontinental trails of today are features of this exhibit.

The revolving platform, on which these scenes are shown, is synchronized with a series of mechanized maps so arranged that a highway map of the period always is visible with each related scene of the diorama. This impressive exhibit tells the whole story of our national highways and transportation from the beginning of work on the famous National Road or Old Trails route (now U. S. 40) up to the present time.

Every motorist who visits the Century of Progress will be interested in the tests of streamlined models of motor cars in a dwarf-sized wind tunnel supervised by engineers of the Bureau of Standards. This portable wind tunnel, designed and built for display at Chicago, is twenty-five feet long and is equipped with an electric fan, with blades four feet in di-

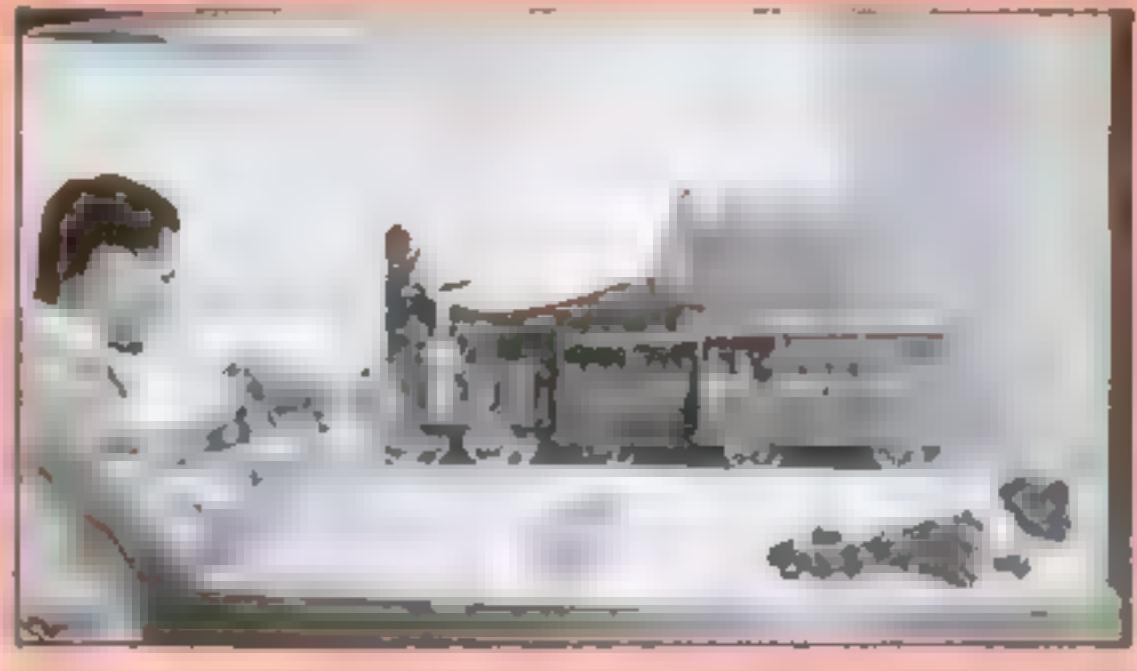
ameter, capable of producing a sixty-five-mile-an-hour wind. A cutaway section in the wind tunnel has been faced with glass so that the spectators can watch the tiny automobile models mounted in the tangle of the artificial air blast, and at the same

time see the special devices and gages that record the effect of the wind on a moving motor car.

One and one-half tons of steel have been delivered at the Federal Building on government order for tests in the jaws of a huge machine that reproduces the tests made for various industries by the Bureau of Standards in its Washington laboratories.

Operated under electric control, a new automaton tests the durability of leather samples for use as shoe soles. The samples are mounted on a perpendicular, rotating wheel that moves at right angles to another revolving surface faced with emery dust. Through the angles and mountings of these wheels, the leather is subjected to the turnings, twistings, and pressures it would undergo if made into soles. Twelve samples are tested simultaneously on this machine. About 40,000 revolutions of the apparatus occur before the best sole leathers fail and crumble to mincemeat. Rubber soles, floor tile, and linoleum are also tested in this practical way.

Another apparatus, recently perfected by the Bureau of Standards, consists of an electric recorder that tells how long paint, used as a protective coating on steel pipe, will last. The public will get its first glimpse of this automatic tester at the Century of Progress show.



LIGHTHOUSE AND BEACONS

Hoover Dam
Water Power
Electric Light
Water Supply
Navigation
Flood Control
Recreation
Wildlife Protection
Fish Hatcheries
Soil Conservation
Land Reclamation
Navigation



This model of the Hoover Dam, greatest engineering feat of its kind, will be part of the government exhibit.

A bird sanctuary and game refuge constitutes another display, brilliant in natural coloring and so life-like that you watch at one time to see if the waving wild game birds and wild animals are alive or mounted. This exhibit tells the story of wild life conservation and the federal stewardship of national timberlands. The attractive outdoor scene, looking as though it had been lifted bodily from some sylvan spot and moved indoors, is composed of trees and shrubbery so true to nature that

cut, replacement trees planted demonstrates the value of timberland in conserving municipal water supplies and the importance of the forest terrain for live stock grazing.

Through plate glass you can study the heart of an artificial redwood tree a giant from the California forest. You can count the birthdays of that mammoth tree in the plainly visible rings of growth.

The importance of forested areas that absorb rainfall and feed it gradually into the soil is demonstrated by an ingenious model in which pumped water percolates like rain through an illuminated channel

This exhibit shows how to get the most for money when buying clothes

Another striking exhibit, a real hoover

new inland places, will

inhouse complete with

and signals and

How the flesh and fleshy

cal high, goes a long distance

of safety will be clearly

The War Department's share in the new will consist of a military encampment of 400 feet wide, array that reveals and daredevil mount by cavalry troopers

holders, who equal the Everest circus

The march of the cavalrymen, the bandler of hounds as the cavalry goes by the blare of the military band, the precision of military formation, and small arms drill will give the visitor a glimpse of every phase of army life

The Army's Corps of Engineers has made for the exposition a graphic bas-relief map of the proposed Nicaraguan Canal. Models showing proposed river and harbor improvements, and other similar activities of Army engineers, will be on display

The U. S. Navy will feature an intricate and effective demonstration. In its animated exhibit, an ellipse fifteen by twenty-one feet represents the ocean with the United States

(Continued on page 95)

• Beer Making Is Marvel



CORN OR RICE
MAY BE USED
OR ELSE ADDITIONAL
AL S ARE USED

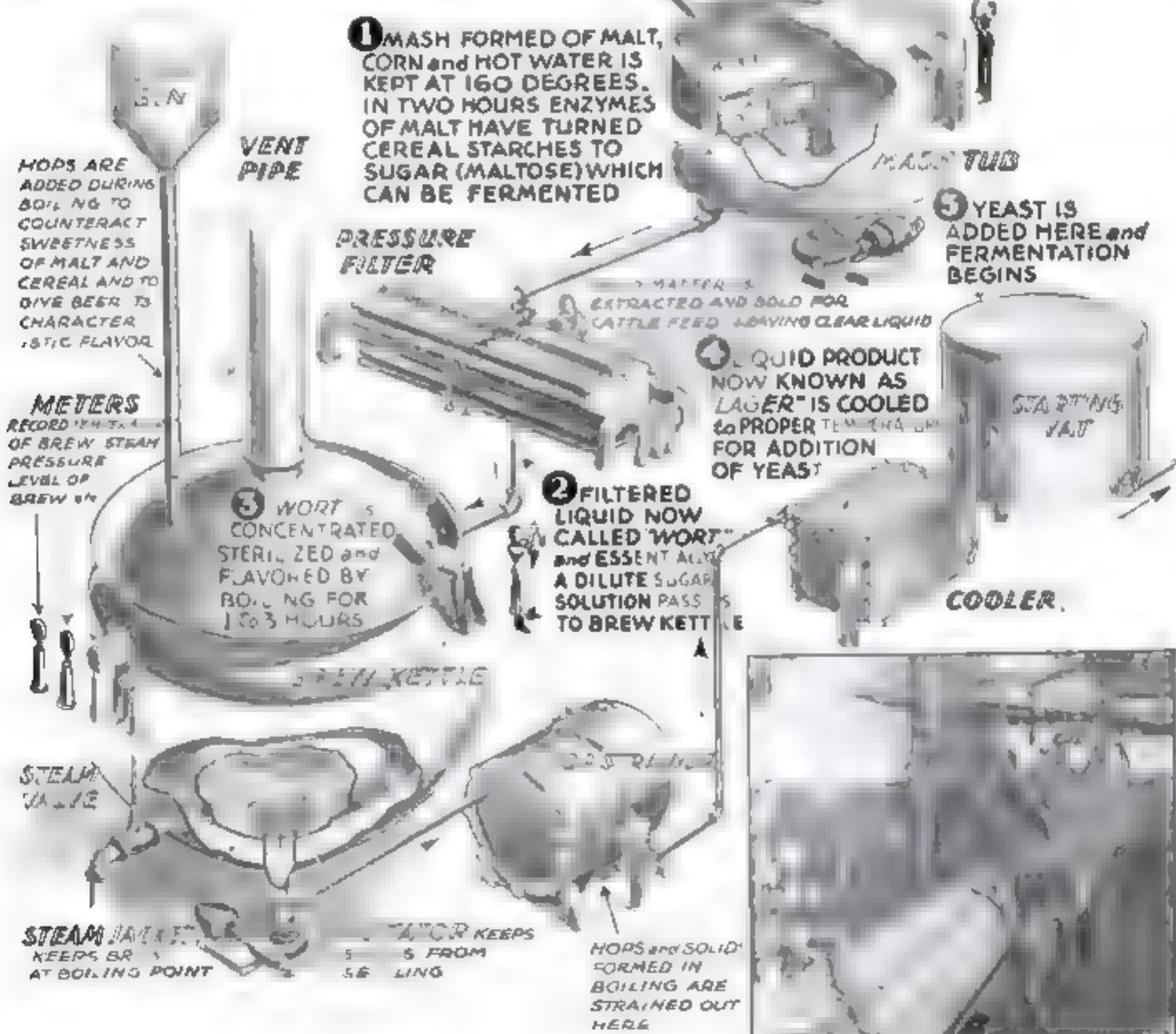
Drawings by
B. G. SEIELSTAD

MALT (SOAKED AND SPROUTED BARLEY)
IS CHIEF INGREDIENT OF BEER,
FURNISHING STARCH AND ENZYMES
THE LATTER CONVERT THE STARCH
TO FERMENTABLE SUGAR

MALT MILL
CRUSHES MALT
IN PREPARATION
FOR MASH

MASHING "RAKES"
STIR MIXTURE THOROUGHLY
UNTIL MASH IS FORMED
WITH HOT WATER

Wort is very gluey in consistency with a flask of yeast
developed for brewing use over a many years past



of Industrial Chemistry

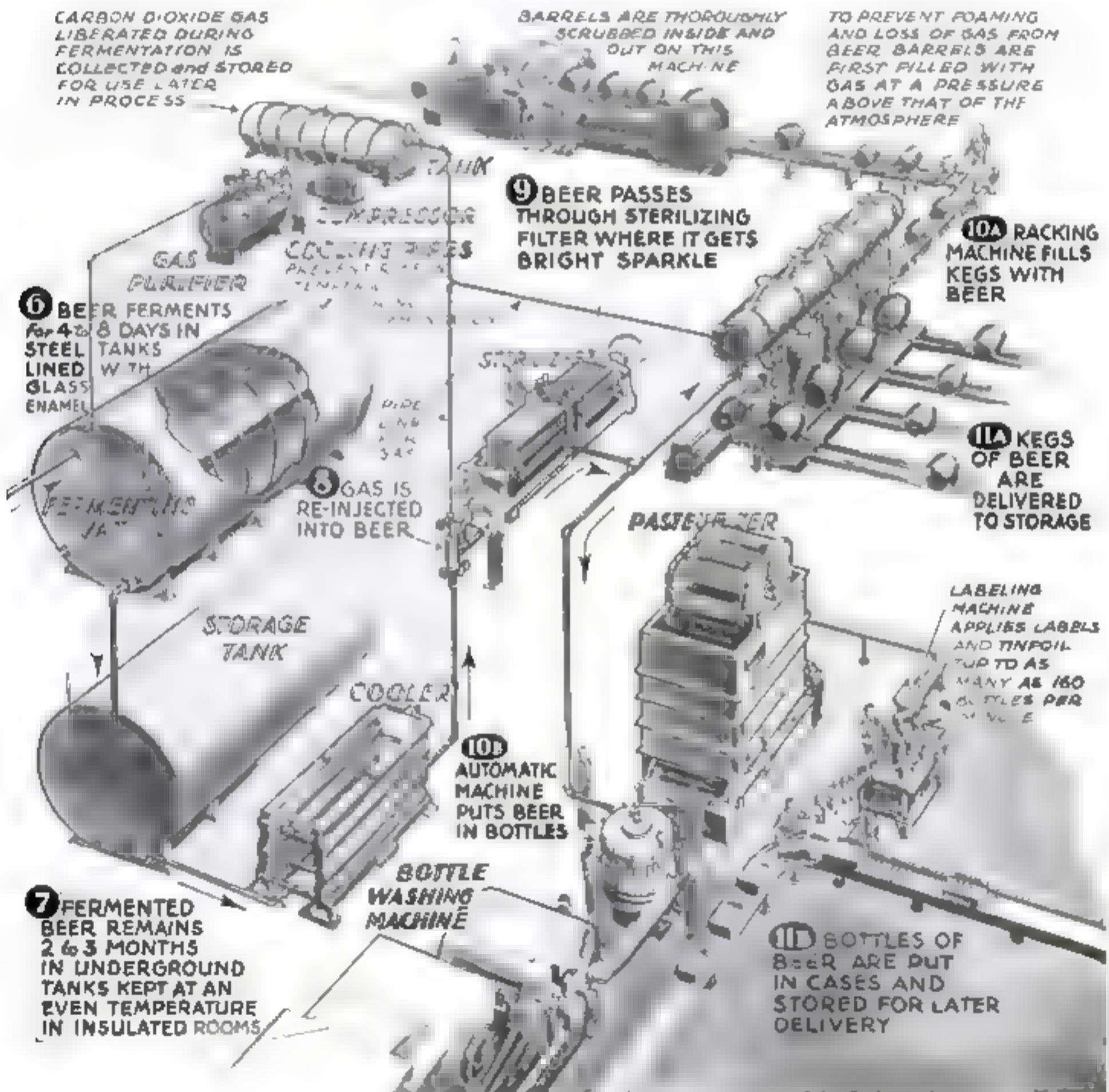
WITH the removal of national restrictions against the manufacture and sale of beer, American brewers are again in action. Their operations represent one of the most extensive applications of modern industrial chemistry. More than 2,000,000,000 pounds of malt, 650,000,000 pounds of corn and corn products, and 41,000,000 pounds of hops are a part of the vast consignment of raw materials that experts will turn each year into beer. On these pages, our artist shows how the transformation is accomplished in

one big and now active American brewery.

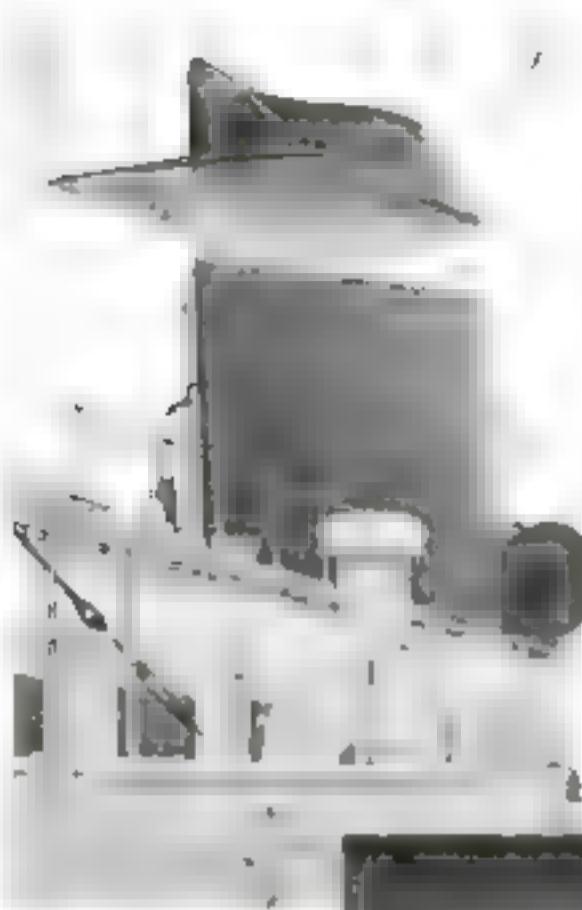
Beer is the fermented product of malted or sprouted grain, usually barley. Its manufacture requires the conversion of the grain's starch into fermentable sugar, and the transformation of this sugar, by fermentation, into alcohol and carbon dioxide gas. During the process, the beer is given its characteristic bitter flavor by the addition of hops, the yellowish-green cones or catkins of the hop vine.

Malt, the principal raw material has previously been produced by steeping, sprout-

ing, and drying barley. Germination develops an important enzyme or digestive fluid called diastase, capable of turning the malt's starch into sugar. Since this task does not exhaust the enzyme's power, additional starch in the form of corn or rice is often added at the start of the brewing operation. Subsequent steps from the mash to the final product are explained in the drawings. The color of the finished beer depends upon the raw materials; natural malt yields a pale beer, while caramelized, or heat-treated, malt gives a dark beer.



FINS KEEP SMOKE FROM SHIP'S DECK



Fins on the smokestack, above, deflect the smoke from the liner's deck. At right, lower view shows how smoke from ordinary stack trails across the deck. Upper view shows test stack with fins deflecting smoke.

SEEKING a way to keep smoke from annoying passengers on upper decks of liners, New York engineers recently exposed ship models to a breeze in a wind tunnel and pumped smoke up the miniature funnels. The path of the smoky trail, they found, depended on the funnel shape. From the resulting data they designed a new airplane smokestack that deflects smoke currents by means of fins resembling those on the tails of aircraft. The odd funnels have been installed on four new liners plying between New York, Central America, and California, and are reported to have worked with notable success.



PLANE FOLDS TO FIT SPACE IN SUBMARINE

ONE of the oldest needs of naval aviation is an airplane that will fold into the least possible space. Experiments have shown it practicable for a submarine to carry such a flying craft in a watertight tank on its deck. Whenever the undersea vessel comes to the surface, the plane may be assembled and launched for scouting. American and British designers have vied to produce suitable planes. Latest and most compact is a Loening seaplane just completed and tested at Roosevelt Field, N.Y. It can be folded into a space only eight feet wide but its extended wings have a span of thirty-one feet, as shown in the photograph below.



TINY TUBE MAGNIFIER ENLARGES FOUR TIMES

LIVE insects and other objects for study may be placed inside a new vest-pocket magnifier. Its hollow barrel is capped at one end by a lens, and at the other by plain glass. When held to the light, the device enlarges the specimen four times.



DOUBLE-CROWNED HAT SUITS ANY SEASON

EASILY suited to mild or torrid weather is a novel headpiece invented by a hatter of Liverpool, England. A detachable crown may be removed when the mercury goes up, as shown in the illustration above, and perforations in the inner crown provide adequate ventilation for the head.

CANCER GERM REPORTED FOUND BY TWO DOCTORS

STARTLING to the medical world is a recent tentative announcement that the germ of cancer has been discovered. For many years it has been supposed by many authorities that cancer is not a germ disease, and therefore non-contagious and incapable of being treated by a serum. This theory will be upset if experiments of Drs. T. J. Glover and J. L. Engle, two New York City physicians using the facilities of the U.S. Public Health Service at Washington, D.C., are confirmed.

The two men, according to their report, have isolated spore-bearing germs from the tissues of a proved case of cancer of the human breast. When the germs were injected into a guinea pig, the animal developed typical cancerous growths that spread through its body.

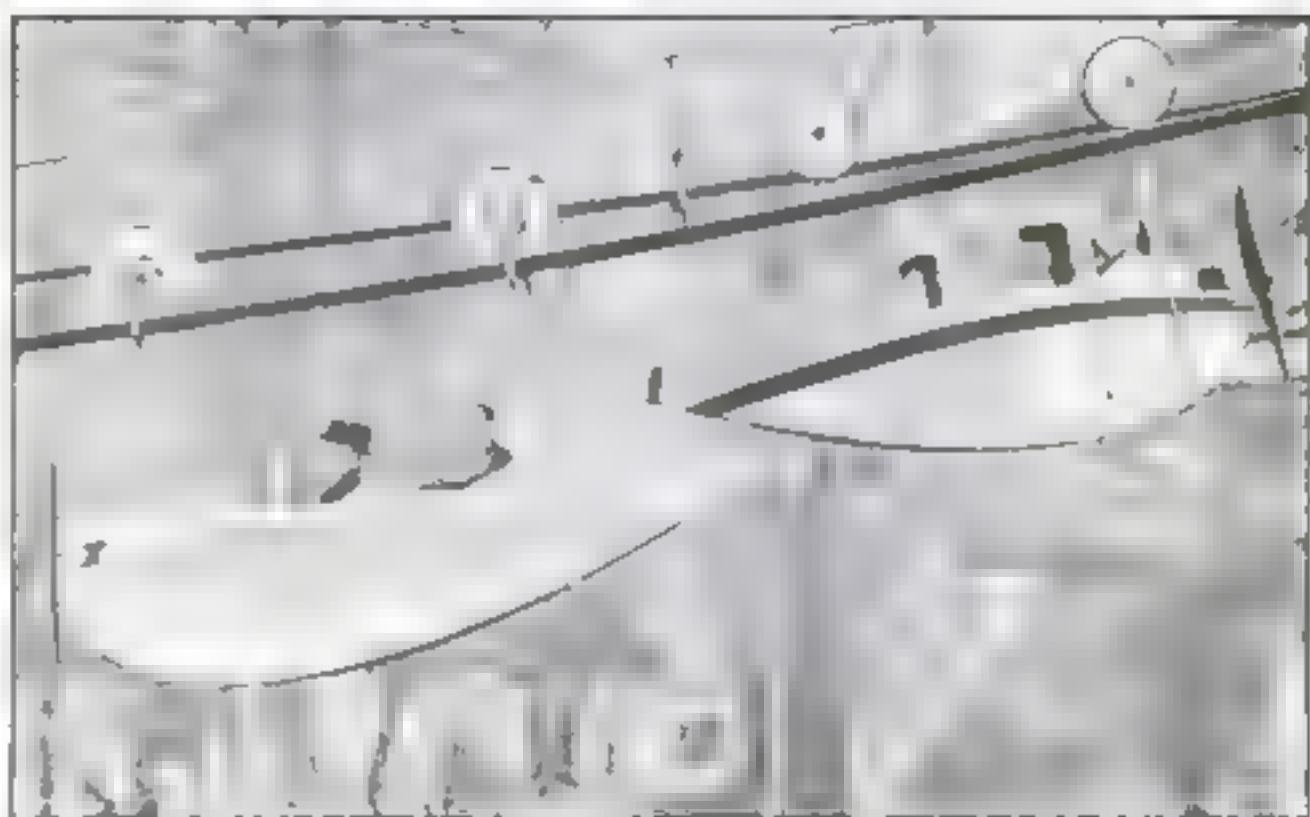
Not all leaders in cancer research are convinced, and further tests are planned to make sure that the germ observed is responsible for the infection. If so, the experimenters will seek to learn whether all kinds of cancer or only one form are germ-borne. Because of the lengthy research needed, the tests will not be of immediate benefit to cancer sufferers.



This airplane, with a wing span of thirty-one feet, can be folded up to fit an eight-foot space on a submarine.

Propeller-Driven Car Hangs from Monorail

An improved airline cab, capable of 155 miles an hour, is the latest invention of the French engineer who developed the trench mortar used during the World War. Suspended on monorails, the cabs resemble airplane fuselages. A small propeller at the front of the cab is driven by a fifteen-horsepower electric motor. The monorail, which guides the car, also furnishes the electric power for the motor. The inventor has been working on air cabs for over a dozen years and has constructed many designs as well as complete air rail systems, many of which underwent severe test successfully but were found too expensive for practical use. In the photograph, two of his airline cabs are shown suspended from the monorail along which they are expected to run at high speed.

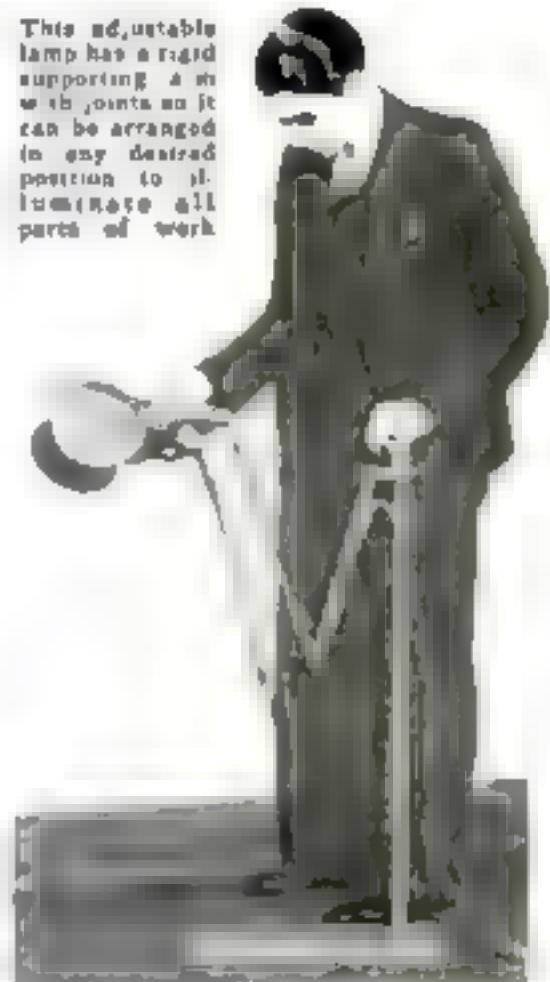


SPRING SHAKES CLINICAL THERMOMETER



After forty years of shaking clinical thermometers before taking the temperatures of his patients, a Los Angeles, Calif., doctor has invented a carrying case that does the work by centrifugal force. After unscrewing the thermometer from its case, it is slipped through a clip at the opposite end. Pulling out a spring plunger and allowing it to snap back into place, rotates the thermometer and the separated mercury is rapidly settled to insure accurate readings of patient's temperature.

This adjustable lamp has a rigid supporting arm with joints so it can be arranged in any desired position to illuminate all parts of work.



ROLL-UP SAIL DRIVES NILE BOATS

Native boats plying the Nile use queer rectangular sails seen on no other waters of the globe. Rigged like a curtain on a pole, the single sail can be rolled or unrolled merely by turning the boom. If more sail is required, the entire sail is lowered until the spoked end of the boom is within easy reach of those on deck. The canvas is then unrolled the required amount. If less sail area is needed, the sail is rolled on the boom. Because of the changing wind conditions in the Nile Valley and the sand bars that spot the river, an easily-controlled sail of this type has its advantages. When landing the rectangular sail is which is lashed vertically so no wind can catch it.

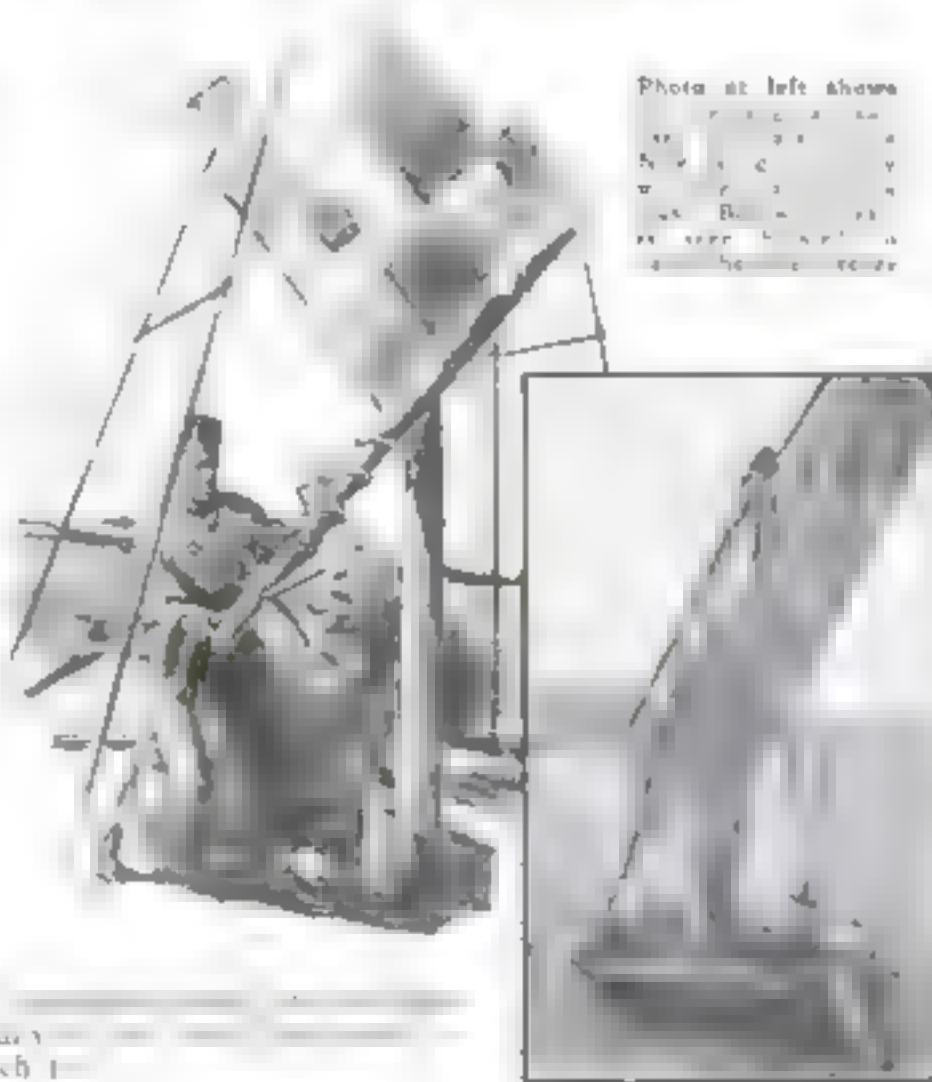


Photo at left shows
Nile boat with
roll-up sail.
Inset shows
close-up of sail.

ADJUSTABLE LAMP FOR GARAGE WORK

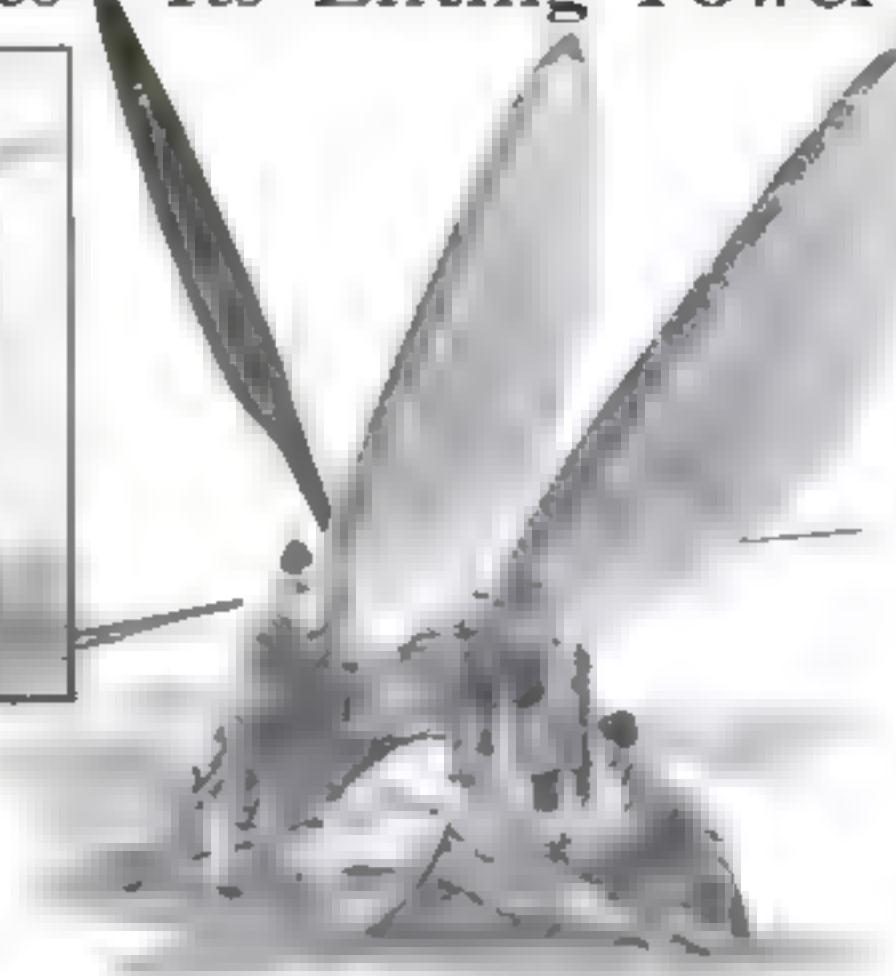
Having a rigid supporting arm that can be adjusted to any position, the lamp standard shown above is particularly valuable in shop and garage work. The carefully shaded light can quickly be placed in a position six feet above the ground or at the floor level—and the easy-working joints in the arm make any complicated angular adjustment possible. With this trouble lamp, no bothersome books or clamps are needed to hold it in position; once adjusted, the light remains in place. A wide wooden base and a strong pipe standard also make the light particularly rigid and its stout electric cord keeps it practically short-circuit proof.

New Helicopter Proves Its Lifting Power



DESIGNED to raise itself vertically and hover or fly forward at will, a new kind of helicopter showed promise in recent preliminary weight-lifting trials at Heston Aerodrome, England. When tethered by slack lines to stakes in the ground, it lifted front and rear wheels alternately under its own power. The lift is obtained from a three-bladed, horizontal propeller. Two long vanes or sweeps, resembling the tail feathers of a bird, are mounted at the rear to stabilize the odd craft. Full flight tests will be made soon and the designer is confident of success.

Rear end of new helicopter as being tried down-pipe (in navy) to the test of its lifting power in England. A view at upper right shows the three-bladed propeller designed to lift the plane when it is whirled by the motor in front.



AUTOGIRLO HALTS FLEEING 'BANDIT' CAR



PILOT USES MIRROR TO REDUCE PLANE'S NOISE

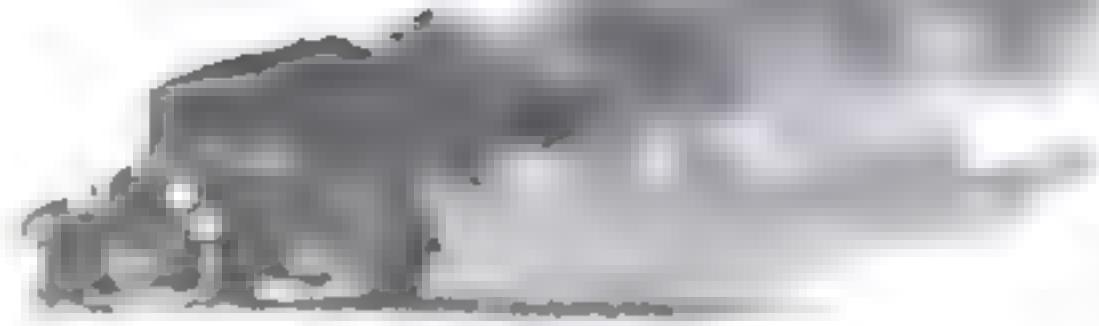
Bio tri-motored planes, linking the United States with Central and South America, are now being made quieter with a simple alteration discovered by a transport pilot. His invention consists of a small mirror attached to the motor cowling as shown in the photograph above, in which the pilot can see the reflection of both the front and side propellers. By throttling his motors until the images merge, he is able to synchronize the propellers and reduce the noise and vibration that occur when they are out of step.



TRY CREOSOTE AS FUEL TO RUN ENGLISH CARS

Creosote is being tested as a fuel for motor cars by engineers in Great Britain. A number of automobiles, recently designed, use the oily fluid, distilled from wood, to furnish power. Several such vehicles are said to be in operation.

To TEST an autogiro in a motor bandit chase, a driverless car recently was sent speeding across a field near Bryn Athyn, Pa. A windmill plane took off in pursuit, carrying Chief of Police Theodore Hollowell. Using a sub-machine gun as at left, he peppered the car until a direct hit disabled it. Tracer bullets set the car afire. The end of the chase is shown below, with the autogiro about to land.



Rider Lies Down on This Bicycle

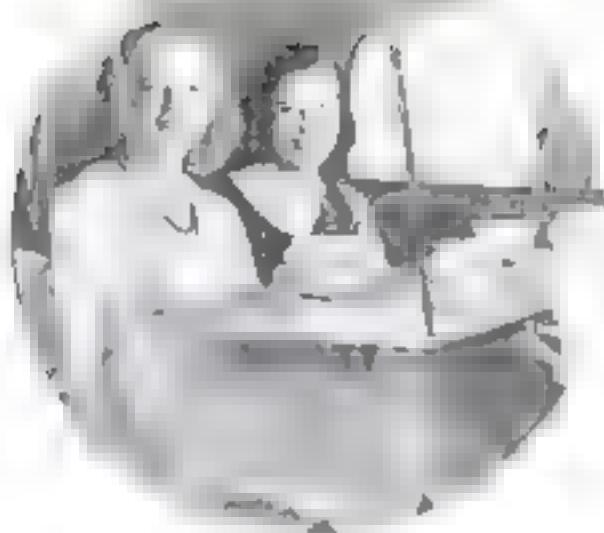


TABLE FITS YOUR AUTO

HANDY for light repasts, a new table may be installed in the back of the car simply by inserting four screw eyes around the sides of the interior. Adjustable supporting straps are then easily clamped on or detached. They hold the table at any desired height. The top is always level, as is shown in photo above.



DESIGNED for comfort and speed, a bicycle of unusual form is being exhibited by a French inventor. The rider reclines in a nearly horizontal posture on a padded seat, with his feet extended forward to the pedals at the front of the

machine. In this position, the wind resistance is decreased and the bicycle may be propelled with considerable velocity. Not the least curious feature of the machine is its steering gear, a curved bar resembling a sawed-off steering wheel.



Gas carbon monoxide fumes

TEST GAS STOVES IN RARE AIR

SEALING themselves in a test chamber for airplane engines, where rarefied air of high altitudes can be simulated, U.S. Bureau of Standards experts recently solved an alarming mystery. Household ranges and gas heaters, approved by leading laboratories, had been found to emit dangerous amounts of poisonous carbon monoxide gas at Denver, Colo. Tests showed the mile-high altitude, with its reduced air pressure, responsible. Flue gases expanded abnormally, blocking escape passages when gas was burned too fast. The data obtained by this unusual investigation will help re-design present appliances, which in some cases may require regulation by a service man to insure safety.



NEW POCKET CASE HAS EIGHT DISTINCT USES

EIGHT distinct purposes are served by the versatile pocket case, illustrated above. A cigarette compartment occupies the center, supplemented by a concealed writing tablet, a telescoping pencil, and a stamp container. In addition the case contains a five-inch rule, a lighter, a pocket knife, and a watch. The entire outfit folds flat into small enough space to fit the palm of the hand, and is so small that it can easily be slipped into your vest pocket exactly as an ordinary cardcase is carried.



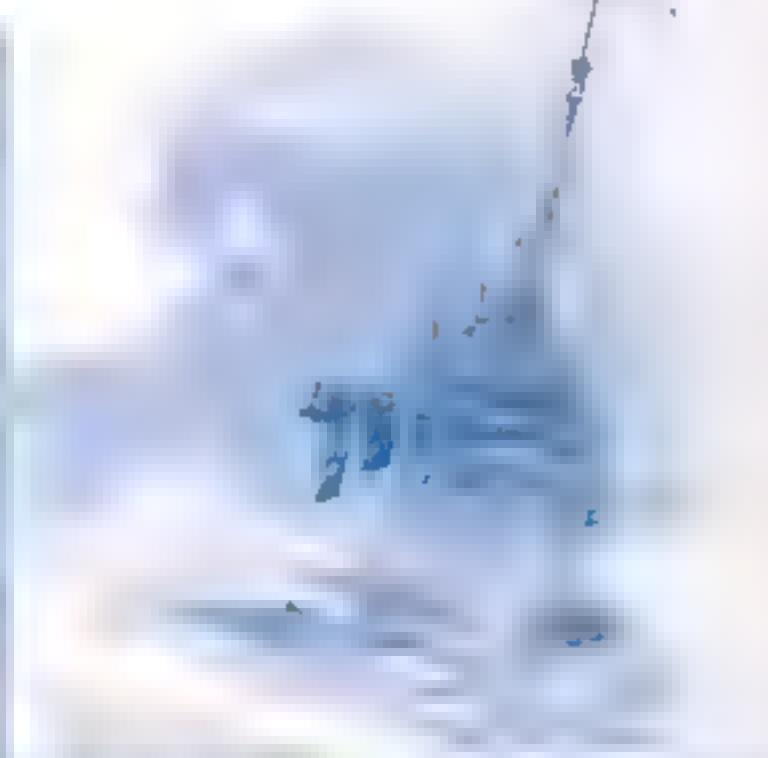
Card, red on one side and white on the other, is clipped to the driver's wrist and with it he signals his turns to auto behind him

CARD ON WRIST SIGNALS CAR DRIVERS

A FLIP of the wrist enables a motorist to signal a driver behind him with the aid of a new hand warning device tried out in England. A hinged card, white on one side and red on the other, is clipped to the wrist by an elastic. When a motorist is about to turn, he displays the red signal to warn the driver behind of danger, but a wave of the hand turns the card over and shows the white side, indicating it is safe for cars to pass on the driver's left-hand side.

Big Battleships Triumph

Over Bombing Planes in War Game



See Also: [The Big War Game](#)

[Prev](#) [First](#) [Last](#) [R-1](#)

[Screen Attack](#) [Print](#) [C](#)

THAT the ships of the line can still guard a coast against surprise air raids was the lesson drawn from more than a month's maneuvers of the U. S. Navy in the Pacific, illustrated on these pages. Many observers were beginning to believe armored battleships were unfitted for modern naval combat. To test this idea, twenty-four of the Navy's fastest vessels, including the airplane carriers *Lexington* and *Saratoga*, raced toward the California coast in a surprise attack. From the moment the destroyer packet *Torpedo* gave the alarm, the big guns of defending battleships decided the outcome. Caught unawares, the carrier *Lexington* was "sunk" by the battleships *Oklahoma* and *Texas* without being able to launch a single plane. The battleship *Pennsylvania* "shelled" the *Saratoga* and chased the carriers a sea, while its planes still groped through fog in an ineffectual attempt to bomb San Pedro bases.



STATELY PARADE
OF MONARCHS OF SEA

Battleships of the United States Navy give an impressive demonstration of power steaming along with the *Colorado* leading



From the speeding destroyer *Roper*, depth bombs are being dropped. One of these bombs will disable a submarine if discharged near it.



Down the ways at Newport News, Va., goes the newest aircraft carrier, the *Ranger*. This is the first U. S. vessel designed especially as a mother ship for planes. The other carriers were converted from old battle cruisers.



Fast cruisers, left, lay a smoke screen behind which the battle fleet can maneuver hidden from the scouts of the attacking forces. This defense measure was successfully carried out during the recent war operations off the coast of California.

AMAZING SKILL with UNSEEN STRINGS



gives life to

Most Famous Puppets

FOR HUNDRED performers, moved by miles of wires and strings, are now touring the country presenting the most elaborate puppet show of history. Known as the Teatro dei Piccoli, "The Theater of the Little Ones," the organization has spent eighteen years in fully mounting dances, tap-dances and opera, singers, witches and clowns, balloon fighters and pianists, acrobats and jubilee singers, and even a Mickey Mouse giving 12,000 performances, amazingly alike.

Ten million people in thirty countries have witnessed the 12,000 performances these remarkable marionettes have given. Yet the most interesting action

has gone unseen. It's the drama that takes place behind the drops in the world of wire and mechanism which brings the puppets to life. These photographs, made especially for POPULAR SCIENCE MONTHLY, give you this glimpse behind the scenes.

On the circle—an overhead platform at the rear of the stage—the apprentices, who control the movements of the marionettes, operate the wires with their skins or fingers, placing one hand every turn on the wrist; every movement of the fingers is vital to the action of the little ones on the stage below.

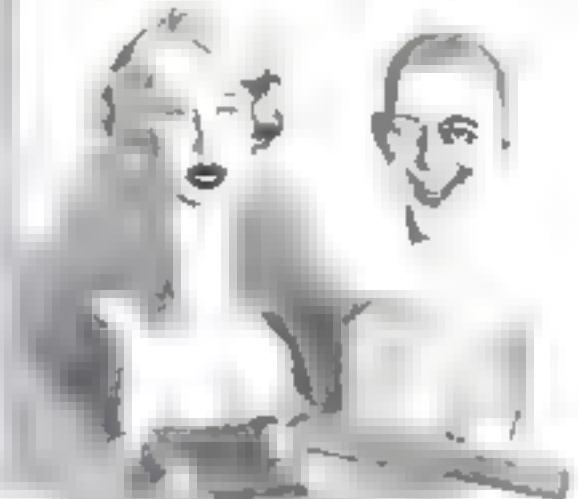
The puppeteers are recruited from families that have practiced the art for generations. In spite of this, seven years' training is necessary before an apprentice is ready to ascend the circle. A fine sense of rhythm and perfect coordination between mind and muscle are the two



Above are puppets on their harps, working the strings that put the little wooden actors through their dances and life-like action on the stage. At right, as the puppet pianist runs his fingers over the keys, no musician that can play and a singer in the pit synchronizes his voice with that of the puppet at extreme right.



Three figures at left are made to dance in unison by the clever manipulation of the hidden strings that control them. Below the puppet heads are artistically carved by real sculptors who take great pains to give each a realistic expression that suits its role.



Thirty Operators Working Eighteen Miles of Wire and String Are Needed to Give a Performance with the 800 Animated Actors that Are Cleverly Molded of Wood

By

ROBERT E. MARTIN

prime requisites for the work. Sometimes, four men are required to handle the wires of a single figure and their movements must be perfectly synchronized to make the actions of the puppet smooth and flowing.

Eighteen miles of wire and string are used in giving life to the 800 wooden actors in the cast. The number of wires attached to the figures range from three to thirty. In some performances, as many as twenty puppeteers are working on the castle platform at the same time and yet not a single wire of the apparently tangled mass is crossed.

The nervous system of each marionette is formed by cords or wires attached to two wooden handles that are held in the hands of the operator. One handle is shaped like a cross. It is held in the left hand and governs the position and maintains the equilibrium of the puppet. The other handle is simply a straight piece of wood. It is rocked back and forth in the right hand or lifted and dropped slightly to give motion to the arms and legs of the marionette.

In some cases, such as in the presentation of a dance by a troupe of chorus girls, a dozen figures are connected with wires so they all move in unison. One operator is all that is required to keep them dancing. He holds two wires like reins and pulls first one and then the other to keep the troupe in motion.

During the performance, the puppeteers lean over a bench-like railing at the



This photo shows the flexibility with which the puppets can be moved.



To this cross are attached the wires and strings that maintain the position of the puppet. The lower handle is used to operate legs and arms.

edge of the castle platform, nine feet above the stage, wearing special padded leather aprons to act as cushions between their bodies and the hard wood. Often they become so engrossed in the action of the little figures below that they open their mouths when the puppets sing, tremble all over when an acrobat strains to perform a difficult feat, and clench their jaws as the little marionettes rush into battle.

At the same time trained human singers and actors, hidden in the orchestra pit, speak the words and sing the songs that seem to come from the moving figures on the stage. Altogether, nearly thirty people are required to give the puppets sound and motion.

The 300 stage settings are designed for rapid shifting. The transition from one background to another is accomplished while a few bars of music are played by the orchestra. When puppet crowds are



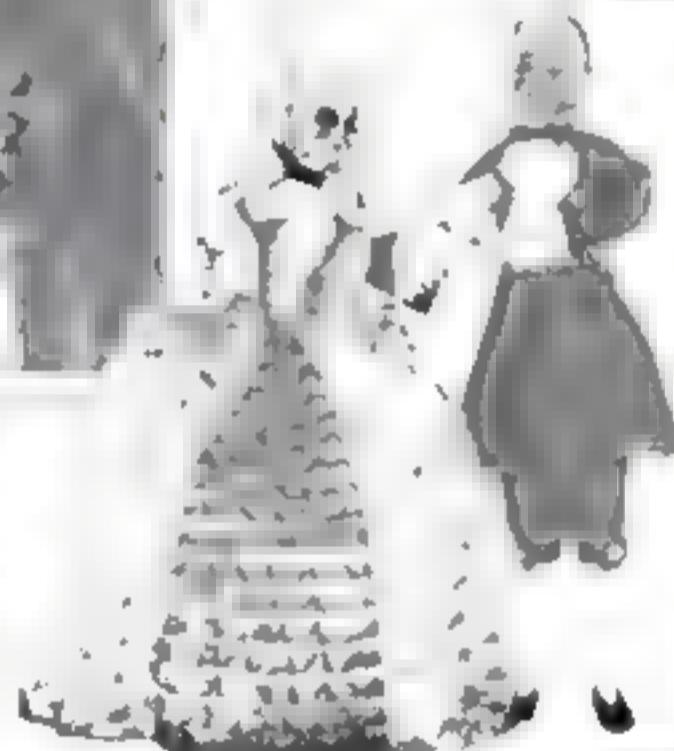
Using the hands and fingers to control a puppet requires years of training as every movement affects the tiny figures

needed in a scene, special preparations are made. Rows of the little actors are hung in the wings. All of the operators except one climb to the top of the platform. Then, the one left below unhooks the puppets one after the other with cat-like agility and swings them over to the stage at just the right moment.

Thus one figure after another moves out from the wings as the puppeteers above walk slowly along the platform to their proper places. Some of the marionettes are hung from hooks and in this way allowed to stand motionless in the background on the stage. But the majority are kept slightly in motion, swaying realistically or taking a step now and then, while the principals carry on the action of the play.

Perfect manipulation of the complicated equipment is needed to prevent tangling of the wires. Some times as much as two years are spent rehearsing a feature before it is incorporated in the show and presented to the public. One of the most famous scenes on the repertoire which includes everything from grand opera to black-face comedy demands almost as delicate handling of the wires as is required of a violinist fingerling the strings of his instrument. It shows a pianist tossing his hair and hammering the keys as he accompanies a quartette of vocalists giving a song recital with appropriate gestures.

Each marionette is about four feet tall. The form of the body depends upon the part the puppet is to play. One has a solid trunk and unbending legs; another joints at the waist, shoulders, knees and ankles. Acrobats sometimes have arms and legs which, unseen by the audience, detach themselves and reattach them



Dressed in the costumes they wear during a performance, these actors wait for their cue

selves automatically to enable the wooden athletes to perform difficult contortions. The wires hooked to the various parts of the figures must be frequently adjusted to insure just the right tension.

Local sculptors carve the heads of the marionettes. Each puppet is given features to fit the role it plays in the performance and the faces are painted to give realistic expressions. Hinged jaws allow the mouths to open and close in synchronization with the words spoken by the invisible actors in the pit.

While most of the heads are carved from wood, some are made of plastic material and a few are built up of squares of silk pasted one on top of the other until the desired shape is achieved. To provide for emergencies, an elaborate "hospital" equipment (*Continued on page 95*)



FREAK MOVIES

Easy with New Amateur Camera

A NEW sixteen-millimeter movie camera now places the professional's bag of tricks in the hands of the amateur.

Fade-outs, double exposures, animations, and enlarged close-ups are only a few of the unusual shots that can be obtained merely by pressing buttons.

Besides lens turret and slow-motion shutter, this new product of the Eastman Kodak laboratories in Rochester, N. Y., has a number of other improvements not found on the ordinary high-grade home movie camera. A crank that runs the film through the camera backwards, an accurate, geared film footage indicator, a unique focusing device, and a shutter that

can be opened or closed while the camera is operating are important features.

Lap dissolves, the professional trick of fading one scene into another, are accomplished by means of the simple back-cranking arrangement and special shutter. At the end of a scene, the footage indicator reading is noted and the shutter is closed slowly. Then, the film is back-cranked to the original reading of the indicator, the button pressed to start the filming of the next scene, and the shutter opened slowly. Thus, as the light from the first scene is diminished, the light from the second is increased, making the first scene dissolve slowly into the second.

Freak double-exposure stunts are made

possible by tiny masks that slip into a slot at the front of the new camera. The masks come in pairs to split the picture in half either horizontally or vertically.

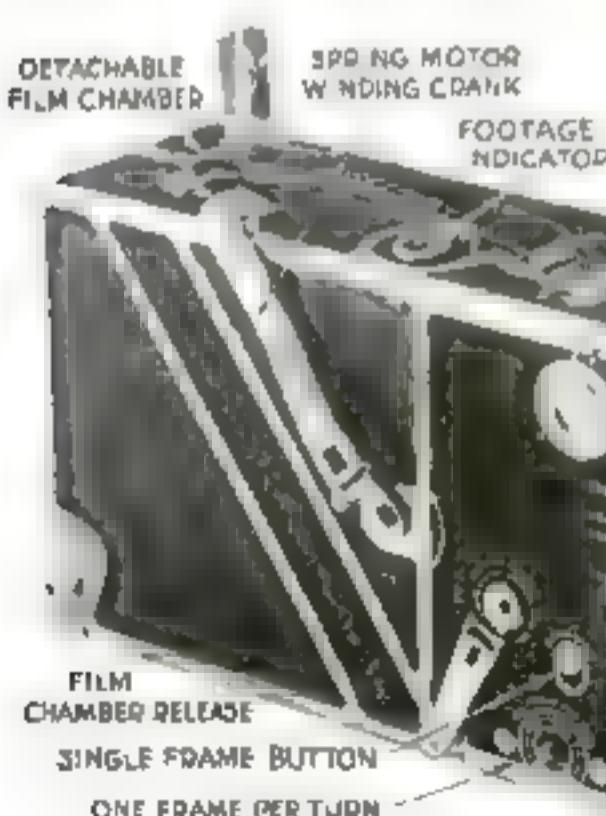
By using the vertical masks and manipulating the back crank and shutter, objects and human beings can be materialized realistically from thin air. Ghostly figures can be made to appear spooks to suddenly into real flesh-and-blood men and the same man shown sitting in several chairs in the same room at the same time.

Dolls and other toys can be brought to life with the animator button on the camera. Each time the button is pressed, a single frame of the film is exposed. By moving the arms and legs of a doll a trifle between each exposure, life-like action can be obtained. When the row of single exposures is projected at the normal speed, the doll will walk, run, jump, or turn graceful somersaults.

A unique focusing device, consisting of a tiny prism that can be raised into place between the lens and the film, increases the accuracy of double exposures made with the new camera. This prism reflects upward against a ground glass mounted at the front of the camera under a magnifying glass. The image formed by the lens. Anything that appears on the ground glass will be reproduced in the same position on the film even when the object is but a few inches from the lens. This makes accurate focusing simple.

As a safeguard, the reflecting prism is so arranged that it automatically drops back from its position between the lens and the film the moment the picture-taking button is pressed.

Although other amateur movie cameras have speed ranges that vary from eight to sixty-four frames a second, the new camera is so designed that the speed can be changed while taking the picture.



Here is the new movie camera for amateurs with the many special features that add to its usefulness.

Gyps Can't Cheat

DISHONEST store-keepers are encouraged to use light weights and short measures by the indifference of their customers, according to Commissioner Joseph P. McKay, of New York City's Bureau of Weights and Measures. Doctored scales give short weight. Crimped-in berry baskets deceive the eye as to their contents. Gasoline pumps can be manipulated dishonestly. Easy prey to these practices is the careless buyer. Tricks of the gyps are exposed in the photographs on these pages, made especially for *POPULAR SCIENCE MONTHLY* with the cooperation of Commissioner McKay. All illustrate cases of fraud discovered by his staff—many crude, a few subtle enough to fool any but the Bureau's trained experts. One gyp, for example, installed a foot-peal system worthy of a crooked gambling hall to control the weight registered on his scale. No one can estimate how many hundreds of housewives he cheated.



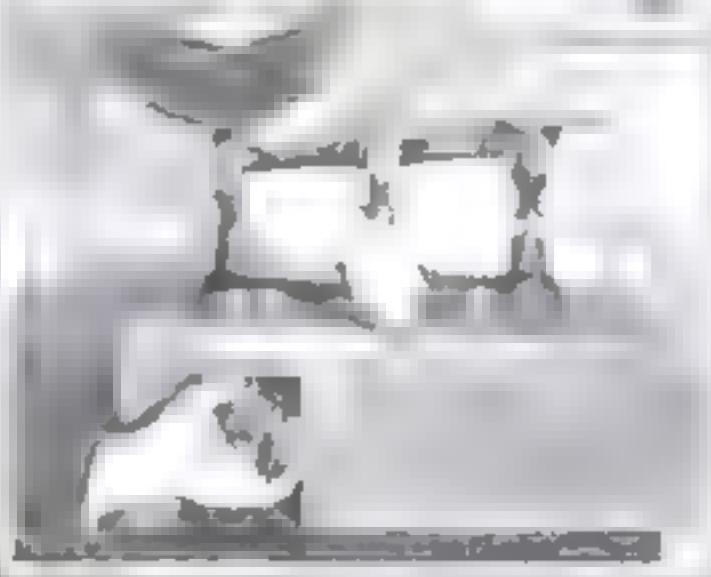
This is a basketful of the gyps' berries as seen by the inspectors of the New York City Bureau of Weights and Measures. Many of them are so twisted and warped when purchased by them the buyers suspect them. One single pint of them in my scale I always buy twice as many and find the buyer



Feeding poultry with lead blocks to make them weigh more is a favorite gyp trick. The lead is hidden under the wing or in the comb near the eyes or the head. These crude forms of fraud cheat many customers.



When you buy berries, watch the shape of the box. If the box is soaked in water, the wood becomes flexible and the sides or bottom are readily bent out of shape so that the box holds only a small portion of the berries you pay for.



Scale weights may look all right on top but when the bottom is exposed large pieces of metal are found to have been gnawed out like is shown below. Making the weights light so they weigh less than they are marked is a favorite form of fraud by the crooked dealers.



You... If You Know These Tricks

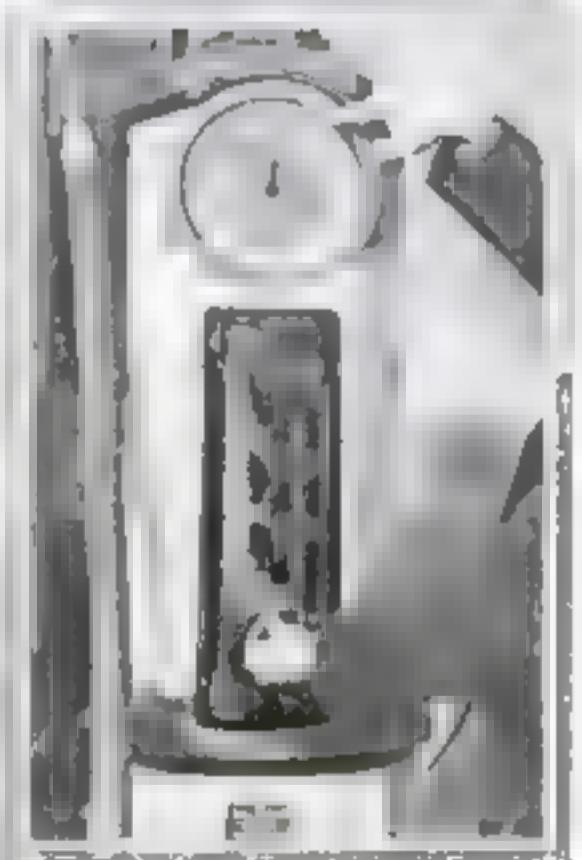


M E A T S
B U R G E R S
S A L M O N
C H I C K E N
P U R R E E
T H E
D E A L E R
W I T H
H I S
S C A L E



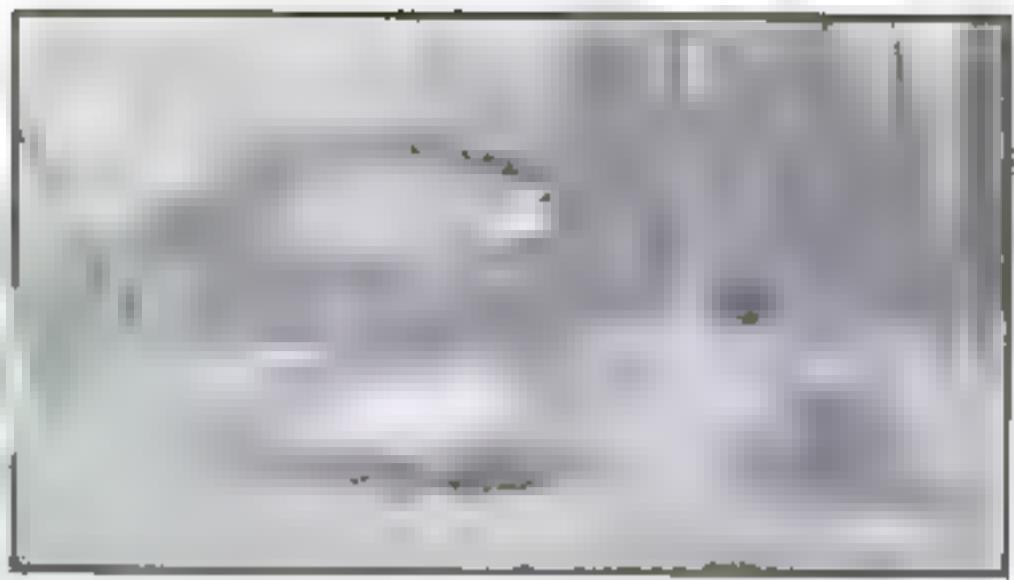
When the meat you have bought is placed on the scale a hunk of fat pork is slipped between the two sheets of paper and its weight added to what you have purchased. The pork is removed before the meat is packed. This trick does not usually work unless you are on guard.

The gyp trick at the right works even with the best modern scales. A handful of chopped beef is pressed against the bottom of the scale pan and remains there, adding its weight to that of the customer's meat. If caught, the crook says he extra meat got there by some mischievous accident.



Some gasoline meters can be tampered with as is evidenced in the photo above. In this type pump the flow of the gasoline can be controlled by a lever inside the pump. If the dealer wishes to cheat, he pushes the one-gallon lever into position and leaves it there. The geared bar, then, will fall only to that point and the buyer is one gallon shy in five

Siamese fighting fish, below, are no fond of a scrap that a g g ass partition a pair in the tank to keep them from killing each other



Raising Tropical Fish *NOW BIG HOME INDUSTRY*



SWIMMING rapidly in flashing arcs are two tiny fish, not over two inches long. From their bodies of pinkish flesh color, dappled light is reflected as they twist about, weaving foamy trails, stirring the whole of their water world.

At intervals, the tiny tempest is stilled, and one fish remains poised, while before it, the other throws itself into a variety of poses, sometimes darting, jiggling, in a quaint sort of dance before the onlooking female. Finally, she finds the virility of the male irresistible, and allows him to lead her to a corner of the aquarium.

Here he has prepared a nest. Laboriously, he has built it with a strange formation of cells under his gill covers, that enable him to blow tiny bubbles on top of the water. To prevent the bubbles

from breaking, he coats each one with a glue-like substance from his mouth. Once the completed nest is floating on the surface like a minute honeycomb, the would-be father hastens to find a potential mother. Having drawn her near the nest by his dancing, he performs an amazing feat. Each egg she lays, he catches in his mouth and places in one of the bubbles.

When the eggs are safe in their floating bubble-nest, there is a startling sudden change in the solicitous fatherfish. He becomes a domestic tyrant, turning upon the mother-fish and driving her from the nest. The pursuit of

courtship may become the pursuit of murder. The father-fish wishes no distraction from his task of guarding and nursing the eggs. Should one fall from the nest, he will rescue it, blow a new bubble, and replace it in the nest. The air in the bubbles will sustain the newly-hatched fry until they are able to go in search of their own food.

That is only one of the surprising things about one variety of the little fish that, in the last two years, have dethroned the sacred goldfish and created a new industry. The engaging creatures that have thus caught the popular interest are among the smallest things in the sea—the tiny tropical fish from the earth's warm waters.

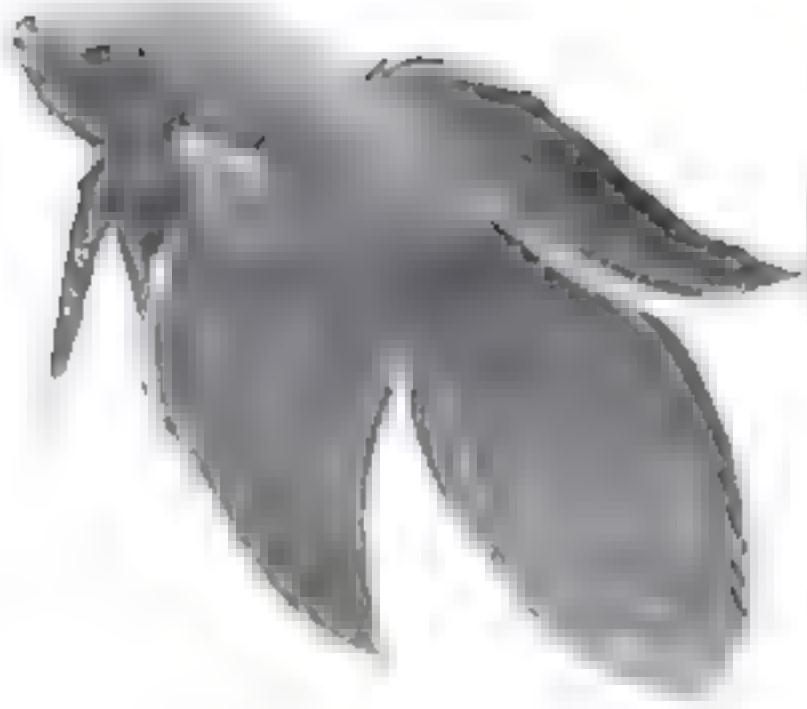
In the last year probably \$1,200,000

worth of them were brought into the country. In the last three months, one dealer sent 3,500 shipments. There are companies that do nothing but import and sell them. There are scores of clubs of tropical fish collectors. Stores have sprung up to sell nothing, and magazines to discuss nothing, but these fish and how to tend them. An amateur breeder of tropical fish, by selling part of his stock from time to time, can make his hobby self-supporting and even cause it to show a profit.

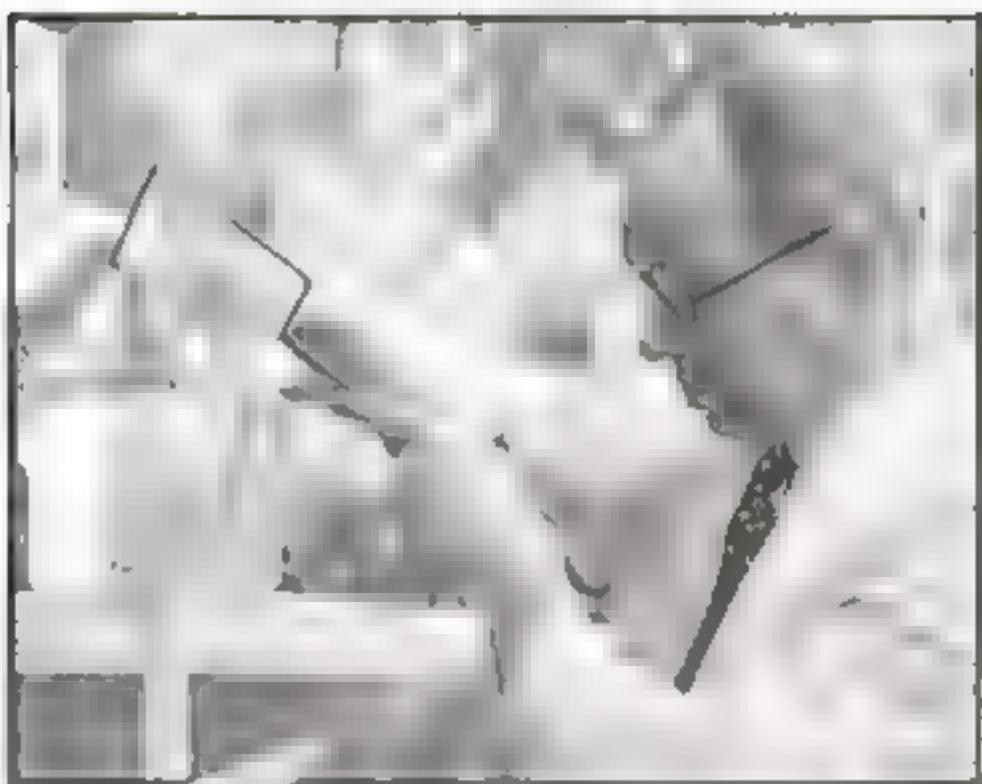
To most people a goldfish is a goldfish bred from the lowly carp, but a tropical fish may be a guppy or a platy or a swordtail, or like the dancing fish of unique courtship and fatherhood, a labyrinth fish. He may be flesh-colored, or bright red, or green, or yellow. He may be striped or spotted. He may turn his colors on or off as environment dictates. The less versatile goldfish doesn't enjoy his bowl, can't breed in it, and soon dies. He is a cold-water fish. The tropical fish likes warm water, and in captivity, he breeds so rapidly that the family that starts with one aquarium may finish with a half dozen, without having bought a single additional fish. Tropical fish live in captivity from five to ten years.

And fun? Watch the Japanese medaka swimming about, looking for a place to hang its eggs. Yes, hang them, for it carries them like a cluster of grapes dangling from underneath its neck. Higher and you dasa the microscopic brightly colored little body. Finally it brushes against some mannot plant and the eggs are detached and hung amid the foliage.

The labyrinth fish and the medaka are but two of the 300 known species of tropical fish suitable for pets. For many life begins, not in the egg, but with live birth, as among mammals. Some West



Artificial breeding of tropical fish has, in many cases, resulted in remarkable development as is seen in the luxuriant growth of fin and tail so noticeable in the specimen that is illustrated at the left.



How to get, feed, and care for tiny household pets from the warm seas, some of them fierce fighters, is told in detail in this article

By Thomas M. Johnson



John R. Chambers, expert aquarist of Bassi Freres, New Rochelle, N.Y., is demonstrating the proper way to filter water out of an aquarium. Note, tube at the end of the hose draws the water from the bottom of the tank.



Introducing water into an aquarium. A bowl is placed in the bottom to avoid stirring up sand and vegetation.

Indian mother-fish have in quick succession six litters of from forty to fifty live babies. An African fish carries eggs and newly-hatched fry in its mouth. If badly scared, it swallows them. Even when they are large enough to venture forth, they will, if frightened, seek haven within its mouth.

No whoever joins the thousands who are installing in their homes aquariums for tropical fish will be interested, fascinated, and kept busy.

Before buying fish, you must have a place to put them. The aquarium tank and stand, you can make according to directions already published in POPULAR SCIENCE MONTHLY, (P.S.M., June, '31, p. 116) or you can buy

them at a special tropical fish store, a pet or animal shop, or a department store. Before filling the tank with water and putting fish in it, however, there are other things to consider and much to know.

Fish need water and space in which to swim, and they also need oxygen and food. To supply plenty of oxygen, the tank should be large enough to afford a good surface area of water; the rectangular tanks now sold are of the right proportions—the old-fashioned goldfish bowl is out of date. The oxygen will be replenished by absorption at the surface. Also, the carbon dioxide that forms in the water must be eliminated. Any of the graceful, fern-like water plants will do that for you, and you can get them where you get your fish.

Tropical fish need warm water. As they cannot stand extreme heat or cold, the temperature should be kept around seven or eight degrees. A thermometer and a lamp heater are good investments. You will need two little nets to remove objects or to move fish from one aquarium to another. Not long after they have begun swimming about their new, modern home, the stork will come. Some morning, you will wake to find your tank thronging like a beehive.

First, which kind of tropical fish do we choose to be the forefathers of this addition to our family? Here they are, in pet shop or department store, all sorts, shapes, and sizes, though none more than five inches long. Prices from \$50 for very rare specimens, to 25 cents to \$5 for the most popular ones. Some are floating quietly, but more are continually swimming about, for mostly they are active little fellows. Each has his special characteristics, his little tricks.

As for me—(Continued on page 94)

Curved Radio Beam Now Lands Planes in Fog

Fog blankets the Newark, N. J., terminus of the transcontinental air lines. Through curtains so thick that 10 feet away are barely discernible, roar of an airplane making crescendo. Well the fog? Suddenly the craft flashes out, drops on the runway in a perfect landing.

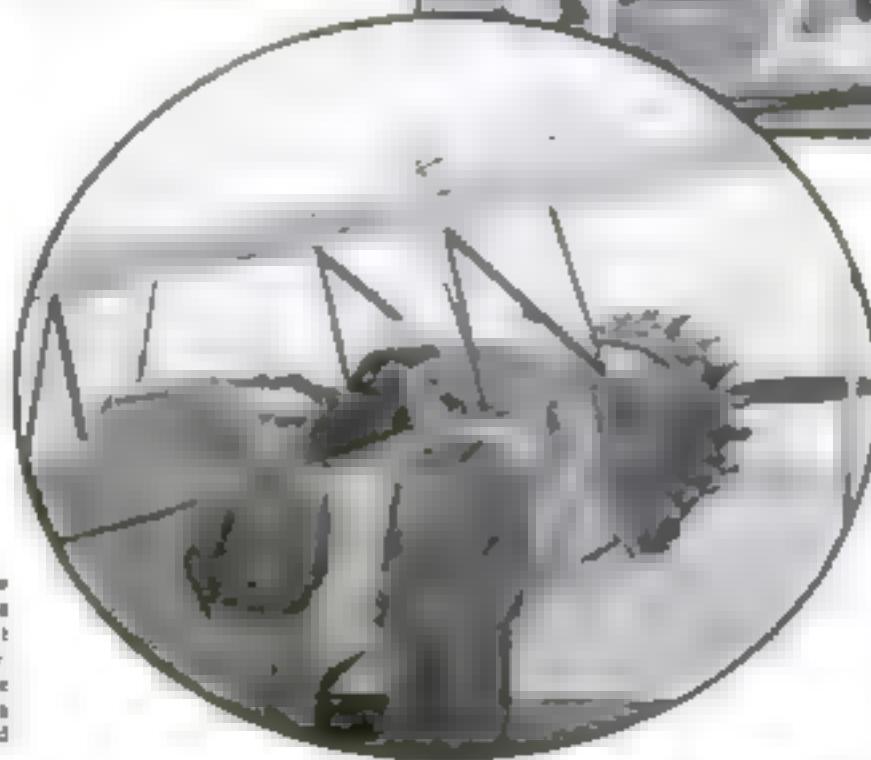
Such a blind landing only recently would have been fraught with the greatest peril. The pilot however knew his way to earth as well as it had been marked with signposts. He is guided by radio's latest gift to aviation—a curved landing beam which, after two years of experimental work, has just been perfected and installed at the Newark Airport.

The new system picks up a fog-bound plane where the standard long-range radio beam fails off, providing the long-sought means of landing safely to earth after his trip between clouds. Its landing beam is a radio signal so projected that it is received at uniform intensity along a curved path, which coincides with the gliding path of an incoming plane. A needle on an instrument board tells him whether he is too high or too low. He can follow the beam down. Auxiliary signals registered on the same dial, keep him in the center of the runway. In addition, the pilot hears two audible signals in his earphones, the first one telling him that he is nearing the field, and the second warning him to level off for a landing. In first tests of the new system, a pilot in a hooded cockpit repeatedly landed his plane.

With the help of the new curved radio beam, the plane shown in oval landed blind at the Newark airport. Below diagram makes clear the manner in which a plane is guided to an invisible bend.



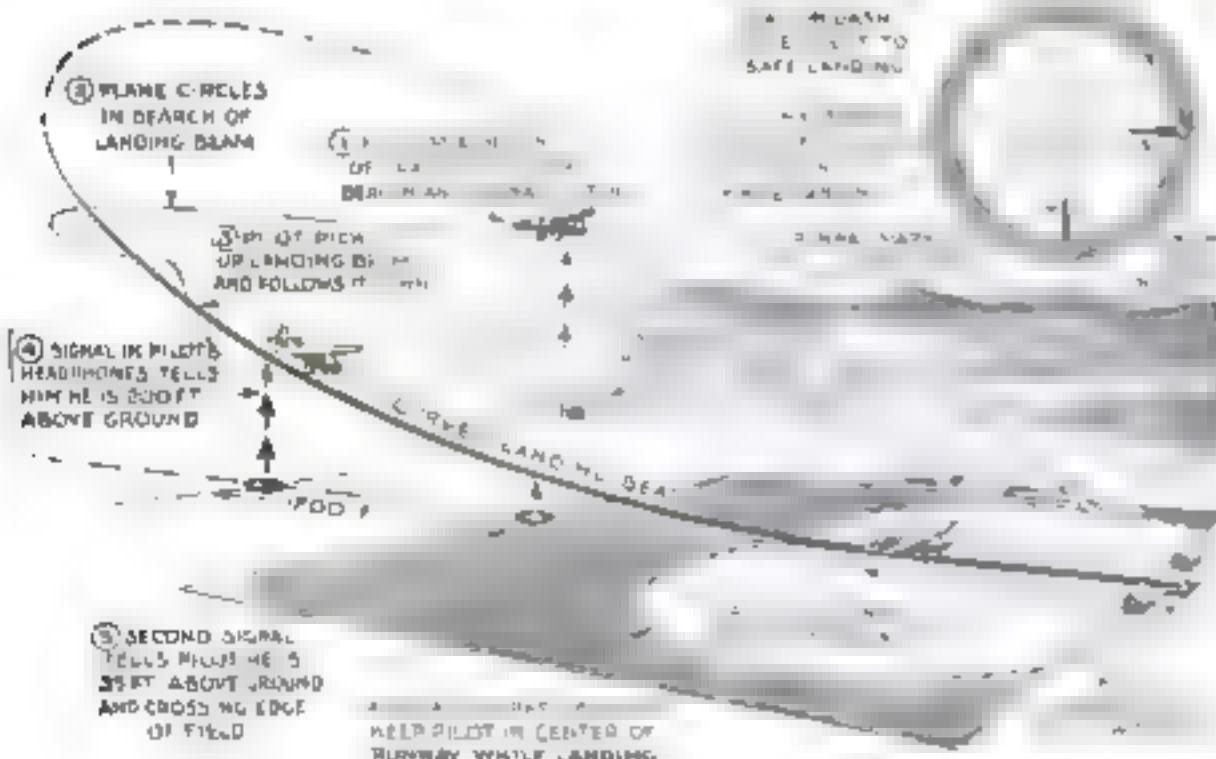
One of the odd-shaped radio towers used in connection with the curved radio beam at a Newark airport.



ALUMINUM CANOE FAST AND LIGHT

The boat in the photograph is 14 feet long and

so light that one person can easily lift it. The odd shape of the boat is thin but durable. A shell of aluminum alloy, weighs only thirty-five pounds. Reduced skin friction in the water as a result of the rounded hull is said to increase by thirty percent the speed of the boat. The photograph shows how easily the new craft may be handled by one person.



England's Most Famous Train Will Tour American Cities



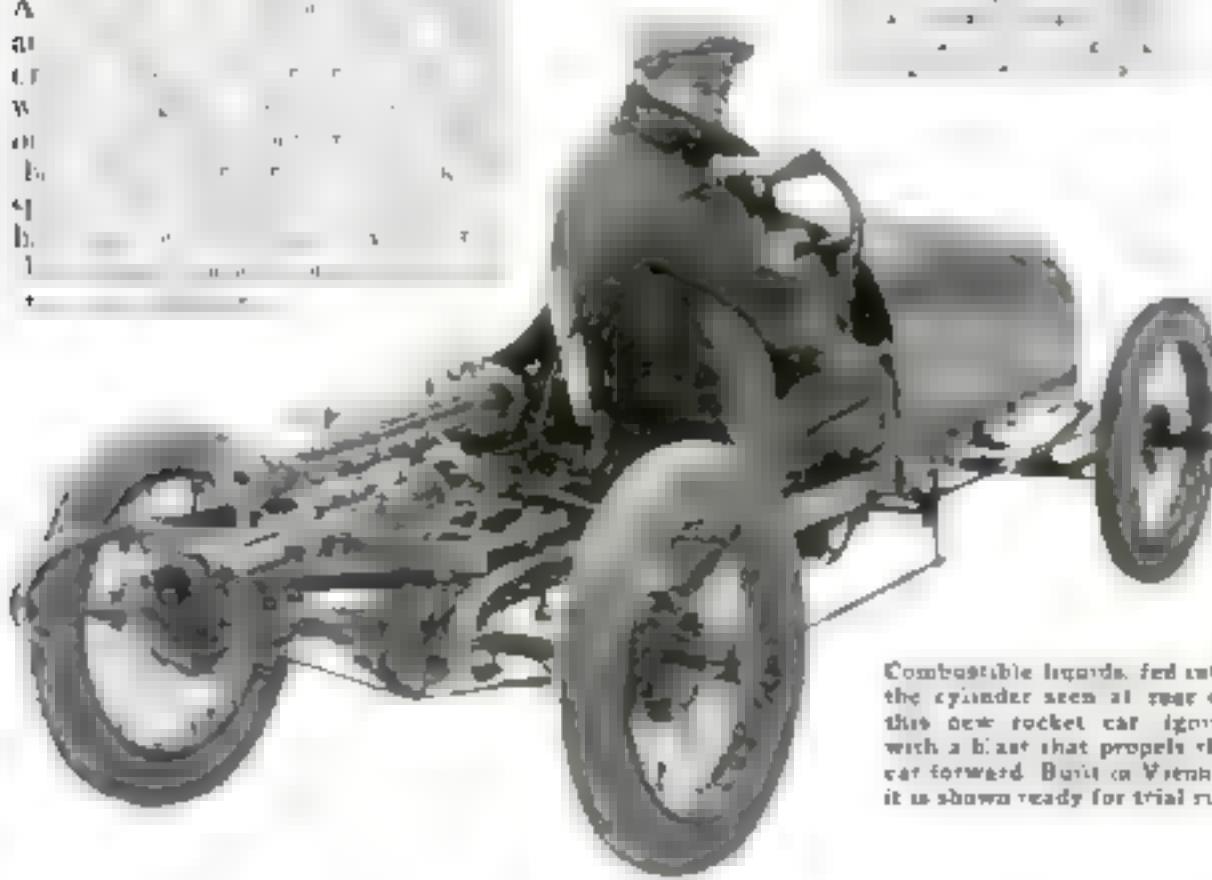
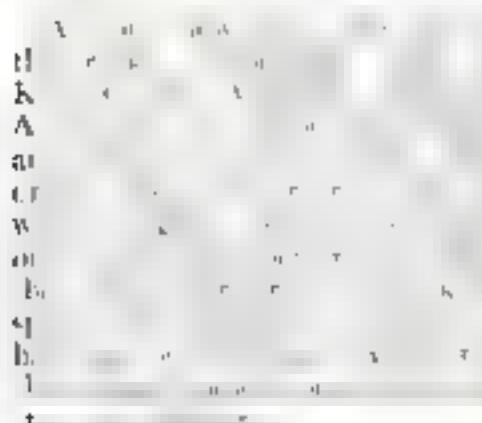
Miss Alice H. Roosevelt, daughter of President Franklin D. Roosevelt, will travel with the Blue Train of England, which is to start about May first under its own power on an tour of United States cities. Later it will visit the World Fair. The train has the record of regular Blue Chip tour.



GARAGE FLOODLIGHTS ON PORTABLE STAND



EXPLODING LIQUIDS DRIVE ROCKET CAR



Combustible liquids fed into the cylinder seen at rear of this new rocket car ignite with a blast that propels the car forward. Built in Vienna, it is shown ready for trial run.

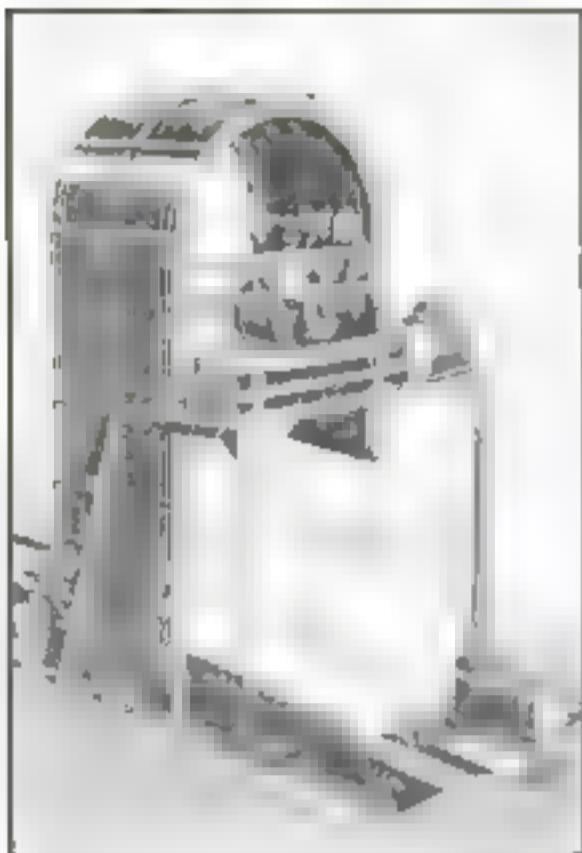
MISS ALICE H. ROOSEVELT, DAUGHTER OF PRESIDENT FRANKLIN D. ROOSEVELT, IS SHOWN IN THE PULLMAN CAR OF THE BLUE TRAIN OF ENGLAND.



CAR BATTERY FILLER HAS AUTOMATIC LIGHT

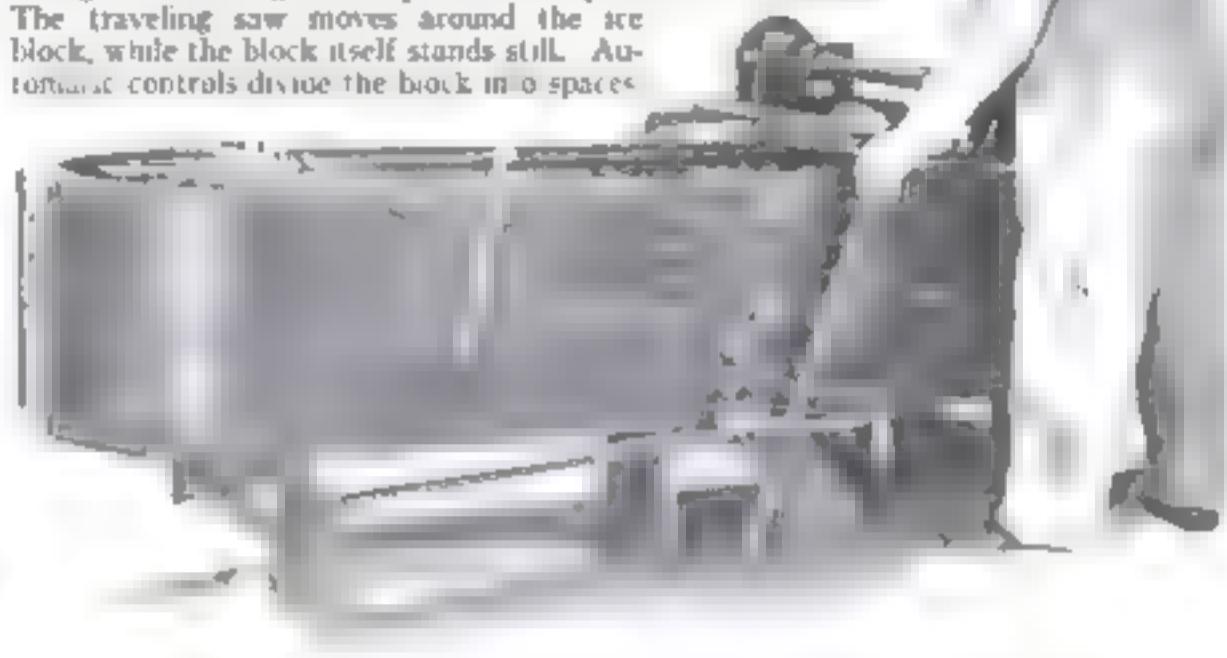
GROPPING for the filler holes of a car's storage battery when adding distilled water is ended by a new self-lighting battery filler. When the nozzle is removed from its socket on the jar of water, a small lamp automatically flashes on and makes it easy to find the right place, as shown in the photograph above. Its concentrated beam also removes the danger of flooding the battery.

Moving Saw Cuts Accurate Grooves in Ice Cake



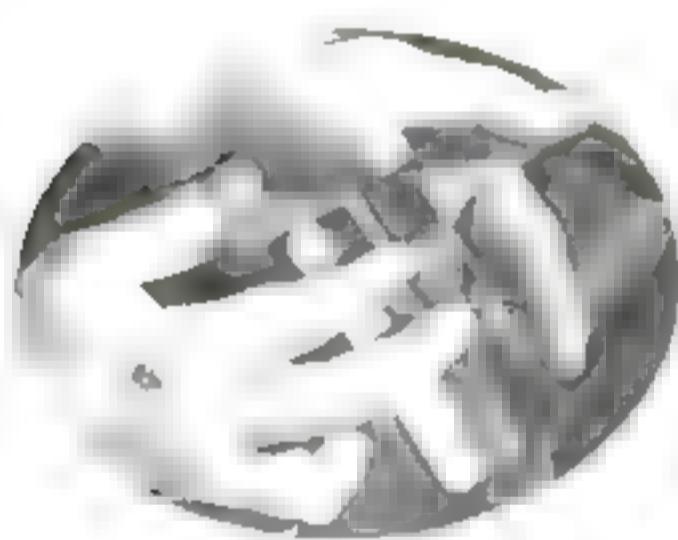
Above: the traveling saw moves around ice to score it cross-wise, and at right saw is tilted to score the ice lengthwise.

To insure accurate weight, a machine that seems almost to think, scores large blocks of ice so they can be cut accurately by the driver of the delivery wagon. The operator merely places the heavy cake of ice in the loop-like portion of the machine and an electric driving motor does the rest. All lifting and handling on the part of the operator is eliminated. The traveling saw moves around the ice block, while the block itself stands still. Automatic controls divide the block into spaces.



HONE OF CURVED STEEL

MADE of rustless steel a new type of safety razor strop reconditions worn blades and improves the cutting qualities of new ones. Striking the blade a few times on the highly polished curved surface restores the edge.



WIRE MOLDED IN QUAKE-PROOF BRICKS

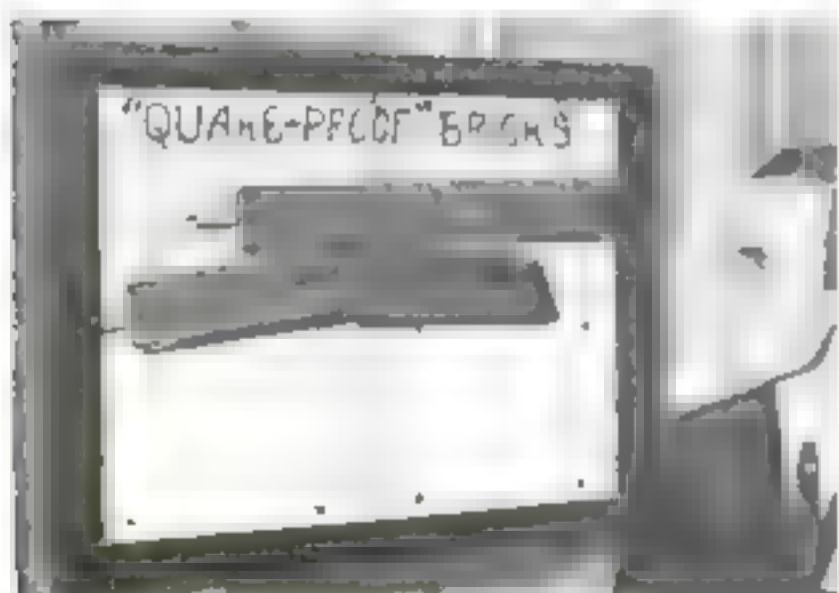


Photo shows wire molded into bricks to make them quake-proof

Bricks that interlock are the builders' newest defense against earthquakes. A strong wire, molded into each brick, forms a long loop at one end of the brick, a shorter loop at the top, and a hook at the bottom. In laying the bricks, the long loop slides into a groove in the adjacent brick while the wire hook engages the loop on the top of the brick below. When mortar is pressed about the large loop, the brick is held in place so no ordinary quake will shake the walls down.



This reflector clamps to rim of auto wheel, cuts headlight of approaching car, and clearly outlines car's left side.

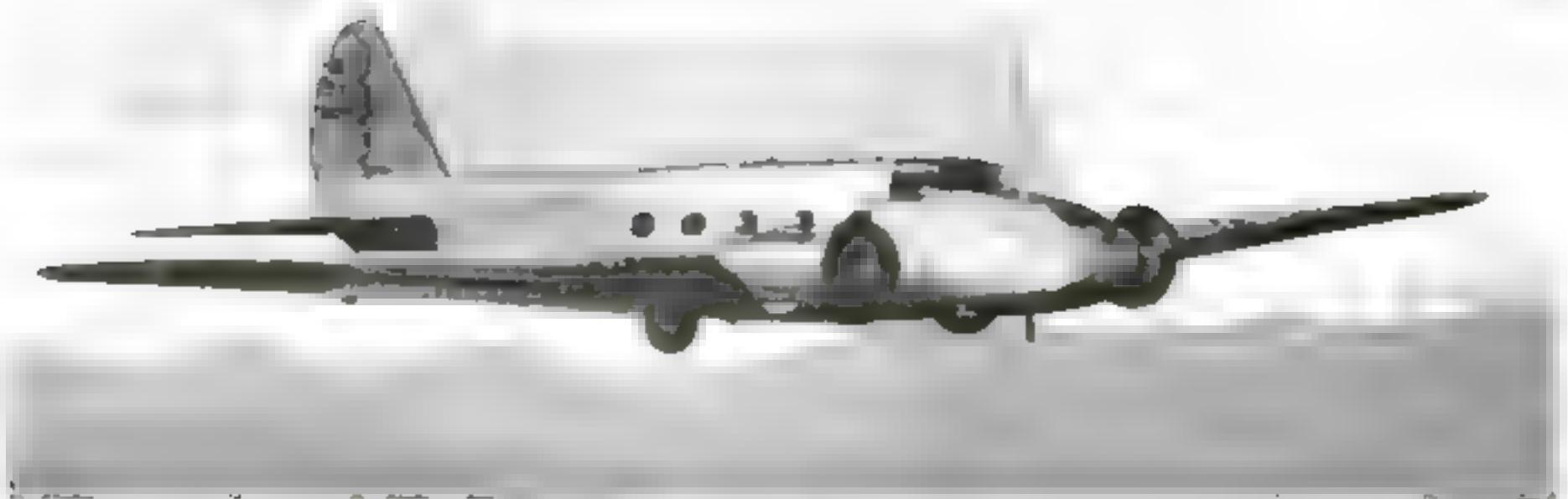
REFLECTORS LIGHT UP CAR WHEELS AT NIGHT

TINY reflectors, attached to the left-hand wheels of automobiles, form a new type of safety device for night driving. The reflectors pick up the light beam from oncoming headlights and create a brilliant circle of light around each tire. These mark the boundaries of the car and guide the approaching drivers. The reflectors are easily attached to the wheel rims and are expected to reduce the danger of cars side-swiping each other.



SMOKER'S ASH TRAY FITS VEST POCKET

A POCKET ash tray is the latest in smoker's accessories. Being only slightly larger than the pack of book matches which it also holds this portable ash receptacle can be carried in the vest pocket. Pushing the two edges of the envelope-shaped tray opens it to receive ashes. When released, the mouth of the tray closes automatically and snuffs out any glowing sparks. Carried in vest pocket, it resembles a small card case.



New Ten-Passenger Planes Fly 180 Miles an Hour

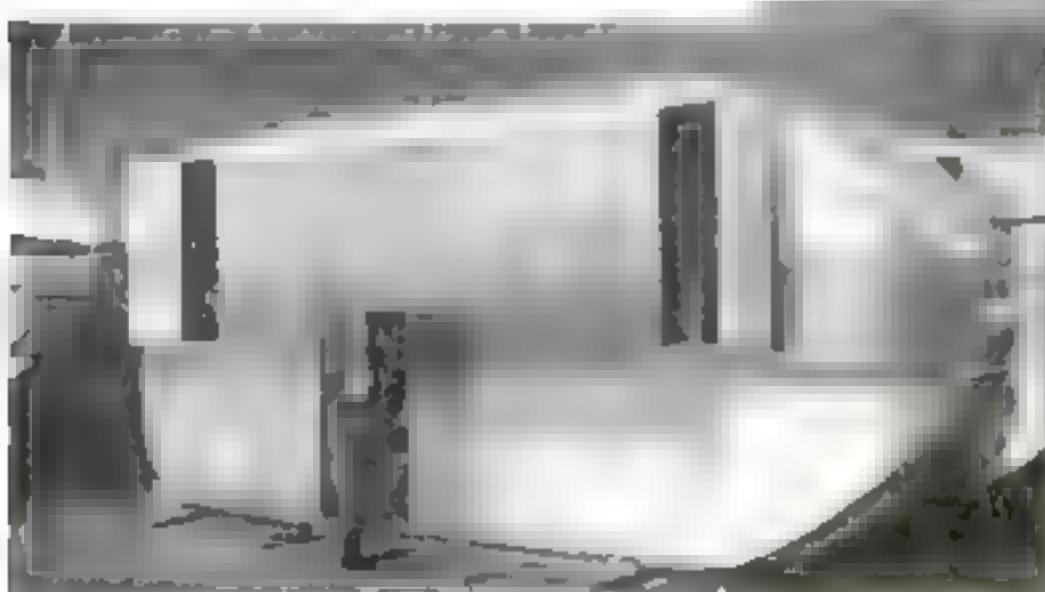
TWIN-ENGINED planes having a speed of 180 miles an hour are being put into service by the United Air Lines on the East Coast. These planes—two-winged

monoplanes carry ten passengers, two pilots, a stewardess, 800 pounds of mail and express, and sufficient fuel to cruise 800 miles. They exceed their cruising speed

is forty miles an hour faster than the present average for mail monoplanes in the United States and may set new time records for commercial flights.

RAILWAY CAR IS MOTOR TRUCK BODY

NEEDING a large motor transport for his sheep and cattle, an Australian stockman recently combined a discarded railroad car and a motor truck. The front end of the car body was pivoted on the truck and the rear end was supported on a trailer. The inside of the converted railway car was divided into separate pens for the animals. The rigid construction of the railway car body made it well suited for the purpose of stock transportation.



GIANT JIG-SAW PUZZLE IS 33 FEET IN LENGTH

STUDENTS at a high school in Longview, Wash., have just completed the largest jigsaw puzzle in the world. It contains 253 pieces and when assembled is more than twelve feet high and thirty-three feet long. Each individual piece measures more than three feet across. The subject of the giant puzzle is a colored picture representing the "Sum of Prosperity" with the "Rainbow of Accomplishment" circling the dome of the sky. The picture, painted on canvas, was glued to a large section of wood veneer. Photograph shows the students assembling their puzzle outdoors.



This old railway freight car was adapted as a body for the motor truck and live stock hauled to market in it.

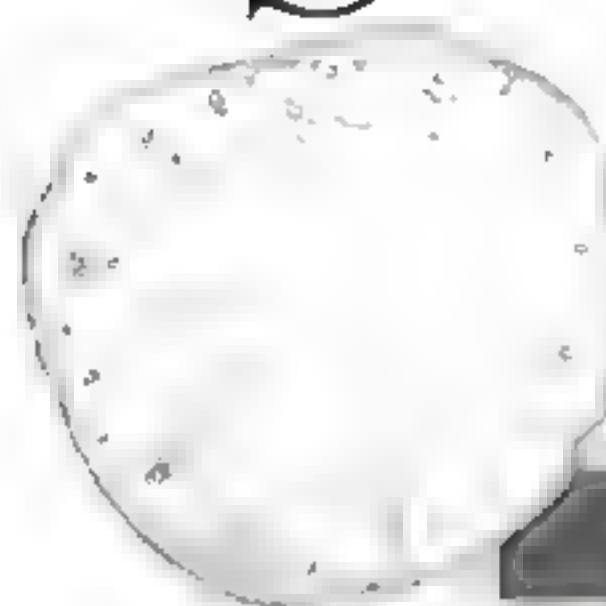
ROCKET CARS TO GIVE VIEW OF CHICAGO WORLD'S FAIR

STREAMLINED cars gliding along 2,000-foot cables will thrill visitors to the Century of Progress Exposition to be held in Chicago this summer. Although resembling the rocket planes of the future, these bullet-shaped observation cars will travel at only five miles an hour. Although the cars are only 200 feet above the ground, the two towers supporting their cables will rise 600 feet. The cars, towed by these cables, spout steam suggesting rocket power.

SECRETS of LIFE

revealed by your

Microscope



Micrograph by New York Biological Supply Co.

Cross section of ponytail stem magnified nine times from which a specimen can be cut

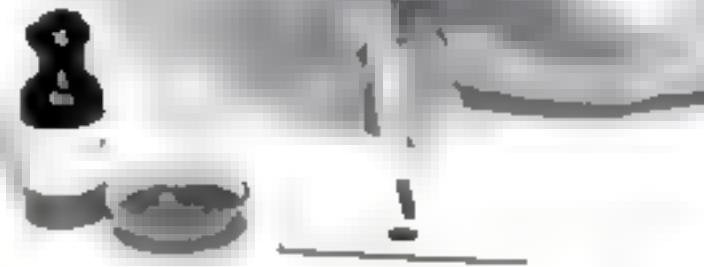
ALTHOUGH we have seen many wonderful things during our little journeys into the marvelous realm that lies beyond our sight there is still much left to do, and a whole universe left to explore.

Even the little microscope we have been using, capable of magnifying only 400 diameters (that is, making objects appear 300 times their real size) opens a territory so vast that it would take us a hundred years to examine all of its strange details.

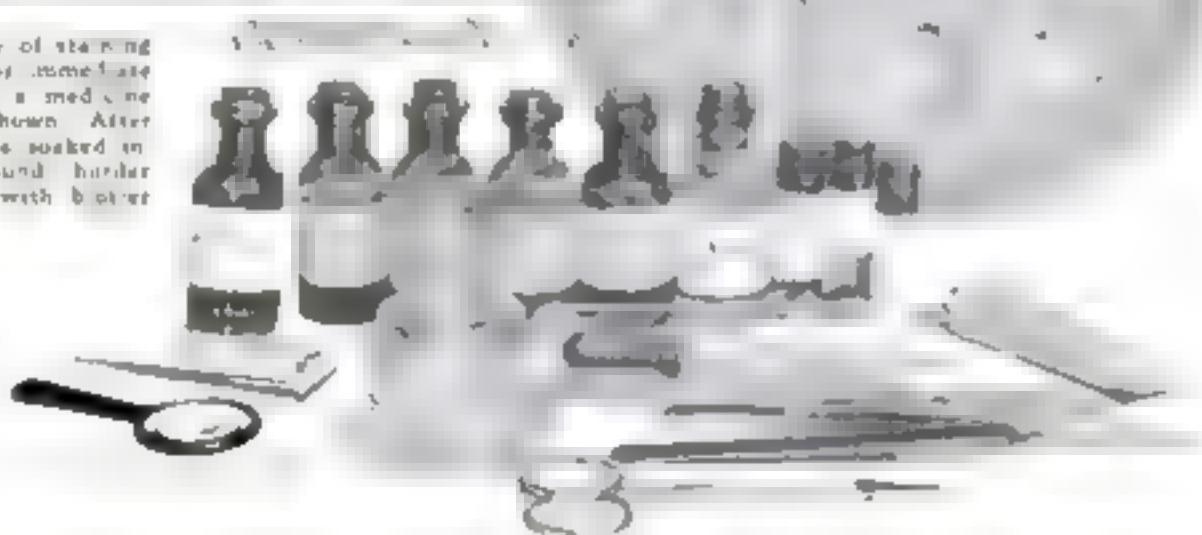
Hitherto we have been dealing with simple specimens that required little skill on our part. Now we are ready to take another and very important step. In the past, we were satisfied to study the surface of things, but henceforth we shall peer into their very insides. This new and exciting work will offer us a close-up of nature that can be obtained in no other way if we actually want to see it.

Let us take the opaque stem of a plant as an example. The real beauty of the stem is hidden from us, since to see it we must look inside where the cells are packed away and where the breath-taking craftsmanship of nature is on display. So what we shall need is a cross section of the stem cut so thin that light will pass through it. This we place under the microscope and see the real inside.

From certain specimens these thin slices may be cut with a new safety razor blade. To do this the specimen, gripped firmly between the thumb and index finger of the left hand, is held down on a piece of glass. Then with the razor blade in the other hand, a slice is cut off as thin as possible. Perhaps we shall have to cut a number of slices before we acquire the necessary skill, but if we are careful we shall be able to prepare some specimens



A quick way of staining specimens for microscope use is with a medicine dropper as shown. After the stain has soaked in surplus around border is removed with blotter



This outfit contains stains, specimens, and special materials. It can be bought for a few dollars.

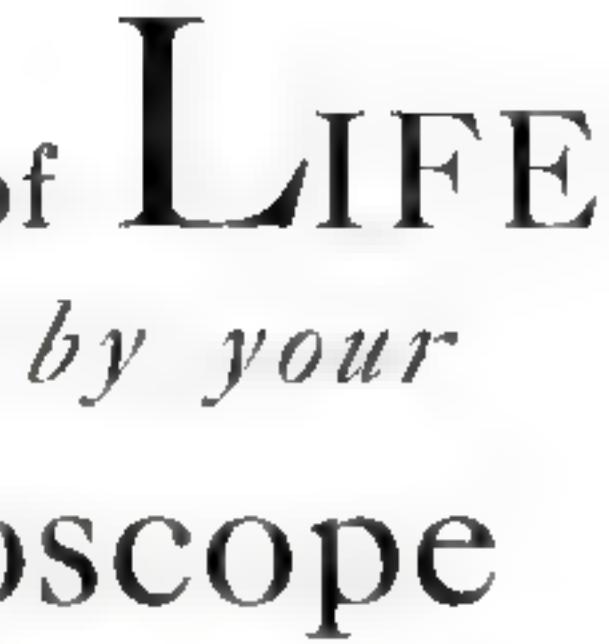
in this crude way. In cutting, the blade is drawn across the stem, as a good barber uses a razor. Merely pressing down on the blade will crush the fibers and ruin the specimen.

To do this work more accurately and easily we can build a handy little instrument that works very much as do the meat slicers in the butcher shops. It is called a microtome.

To make it, we need a piece of heavy brass tubing with at least a quarter-inch bore. The size of the bore will determine the diameter of the specimens that may be cut. In no case will a bore of more than one-half inch be needed.

Into one end of the tube fit a brass plug and solder it in place. Through the center of this plug drill a hole with a No. 29 drill. Then with an 8-32 tap, turn threads in this hole and fit it with a brass screw.

The little table which is soldered to the opposite end of the tube is of sheet brass, heavy gage, and as flat as possible. A



Below: slice cut from the stem of a buckwheat magnified forty times

piece of brass rod that forms a sliding fit inside the tube completes this useful little instrument. With a good sharp razor blade at hand, your microtome is ready for use.

In using it, a specimen is placed inside the tube. As each slice is cut the screw at the base of the instrument is turned slightly so the inside rod will push the specimen forward a tiny fraction of an inch. The cutting is done with the razor blade held close to the surface of the little table in the manner illustrated. By the proper manipulation of the screw sections can be cut only a few thousandths of an inch in thickness.

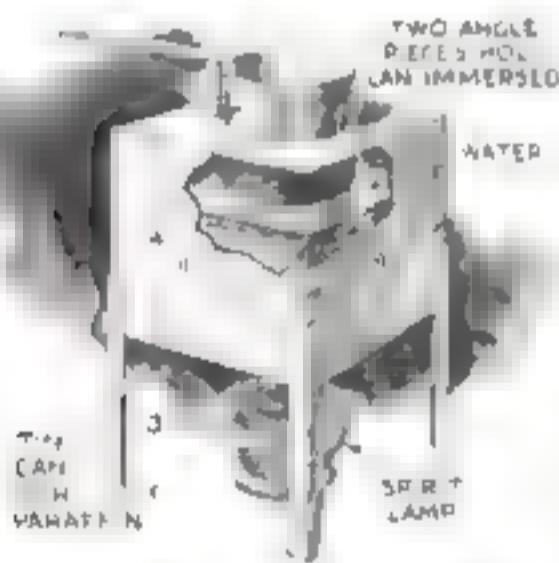
Merely to jam a specimen into the microtome in the manner described however would be the method of an amateur. The professional first puts wax around his specimen so that, while the cutting is being done, it will not be damaged by pressure or squeezing. The delicate stem of an iris for instance could not be cut without first embedding it in wax. Indeed, every biological specimen is thus prepared.



How Specimens of Living Things Are Cut into Thin Slices with Microtome, Mounted on Glass Slide, and Then Stained Is Told Here in Detail

By

BORDEN HALL



Drawing shows how to build heater in which the paraffin is melted without raising its temperature so high it will damage specimen.

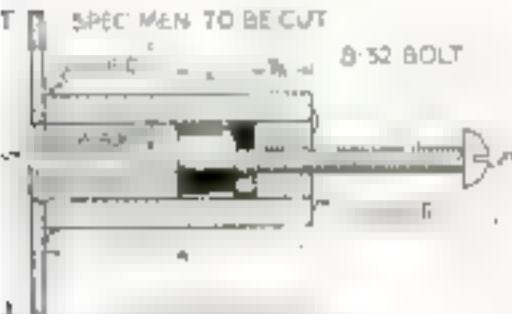
After the specimen has been mounted in place by pouring melted paraffin around it the portion protruding from the end of the brass tube is cut off flush with the table. Then the screw at the bottom of the tube is given a small fraction of a turn and another cut is made. The first cut was simply to level off the end while the second cut provides the specimen. However, if you obtain a perfect slice on the second cut, you will be lucky. Generally, you will find it necessary to make several cuts before you are able to make really thin slices.

After skill is developed at this work and nice thin slices are made, they may be slipped onto a glass slide and brought to the stage of the microscope without

actually touching them with your hands. Another point to be borne in mind in this work is that the paraffin used must not be too hot. If it is, it will tend to boil the water in the cells of delicate specimens and destroy their beauty. To overcome this, we build the paraffin heater shown in the drawing. The use of this little device will prevent the paraffin from heating above the boiling point of water and it will also be good insurance against fires. Also this pot will keep the paraffin warm for a long period of time. In preparing a specimen, it is dipped into the molten wax before it is placed in the microtome and embedded. An alcohol burner keeps the wax hot under the wax.

Unfortunately some specimens require further preparation before they are ready for the little meat slicer. Thick woody sections must be soaked for several days in clean water to make them pliable. When the sections are being cut, it is advisable to dip the edge of the razor in alcohol. Of course, if stems containing resinous matter are used, the soaking will be of little help as resin is not soluble in water. In such cases, we leave the specimen in alcohol for a day or two to dissolve the resin. Then it is placed in water for three more days. In a few cases, it will be necessary to boil the stems in water. In the case of material like the branch of a tree, this process softens the fiber and makes

At left, the proper manner of cutting slices from a specimen with the microtome is illustrated. Below, the drawing shows how to make a microtome and, in circled photo of completed microtome with adjusting screw in place.



The cutting of specimen slices much easier.

As we become skillful in the preparation of specimens, we shall eventually make slices so thin and so nearly transparent, that there will be little left to look at. Hence it becomes necessary to learn how to stain our specimen. A crude analogy will help us understand the reason for using stains. Under certain conditions of light, we are unable to see a piece of glass, a fact that is made use of by magicians in preparing stage illusions. However, if the glass were colored, we should not be so easily fooled. We use stains for the purpose of seeing and to reveal details of structure that would otherwise be invisible.

The kind of specimens we are considering at the moment, however, must be bleached before the stain is applied. This is done by dissolving one ounce of chloride of lime in ten ounces of water. A second solution is made with two ounces of washing soda dissolved in water. The two solutions are then poured together and thoroughly shaken. After standing for a day or two, the solution is filtered and put in well corked bottles.

To bleach a specimen, it is immersed in the bleaching solution for a period of several hours. In removing it, remember the soaking has made it fragile and care must be taken not to crush it. Once out of the bleach, it is necessary to wash the specimen in several changes of water.

The stains to be used should be obtained from a biological supply house. Although the amateur has a large number of them to choose from, perhaps none is better for the beginner than hematoxylin, a red stain prepared from logwood. In using it, a watch glass (*Continued on page 84*)

DARING Gland Operations *Effect Marvelous Cures*

THRILLING feats of surgery, undreamed of a generation ago, mark the work of the modern gland specialist. Personalities are altered, features are changed, growth is controlled, maniacs are restored to reason through delicate operations performed upon these mysterious chemical factories which are constantly active in the human system.

Gland surgery, today, is a realm of bewildering possibilities. Here and there in the present records, we catch glimpses of the wonders that may lie ahead.

Witness a dramatic instance reported only a few weeks ago from Cincinnati, Ohio. A young man became alarmingly nervous. His weight dropped rapidly from 140 pounds to sixty-nine pounds. His eyes bulged from his head with a terrified expression and every muscle in his body constantly quivered. In a few months, he had become a raving maniac, kept in a strait-jacket to prevent his killing himself or injuring others.

The shield-shaped thyroid gland, covering the sides and front of the windpipe just



exert a powerful influence on the mind and personality. These substances are called hormones. They travel about the body

like chemical messengers governing the action of distant organs. The thyroid regulates the life processes of the body just as a damper controls the heat of a furnace. A diseased, over-active thyroid is like an open damper. It burns up the body energy faster than it can be replaced by food and oxygen.

This is what had happened in the case of the young man in Cincinnati. His one chance of recovery lay in a delicate operation which would remove most of the thyroid but leave just enough to keep the body functioning at normal speed. In the operating room of his clinic, the noted Cincinnati surgeon, Dr. Joseph L. De Courcy, performed this ticklish bit of human repair work with amazing results. In a few days, the patient became calm. Then, the mental derangement disappeared completely and, only a few months later, the young man had regained his weight and was able to resume his regular daily work.

Up to a few years ago, operations upon the thyroid gland were accompanied by considerable loss of blood because this



A surgeon at work which is equipped with tele-

By FREDERIC DAMRAU, M. D.



CUTTING GLAND
WITH RADI-KNIFE

Surgeon uses radio-knife to cut through the thyroid gland.

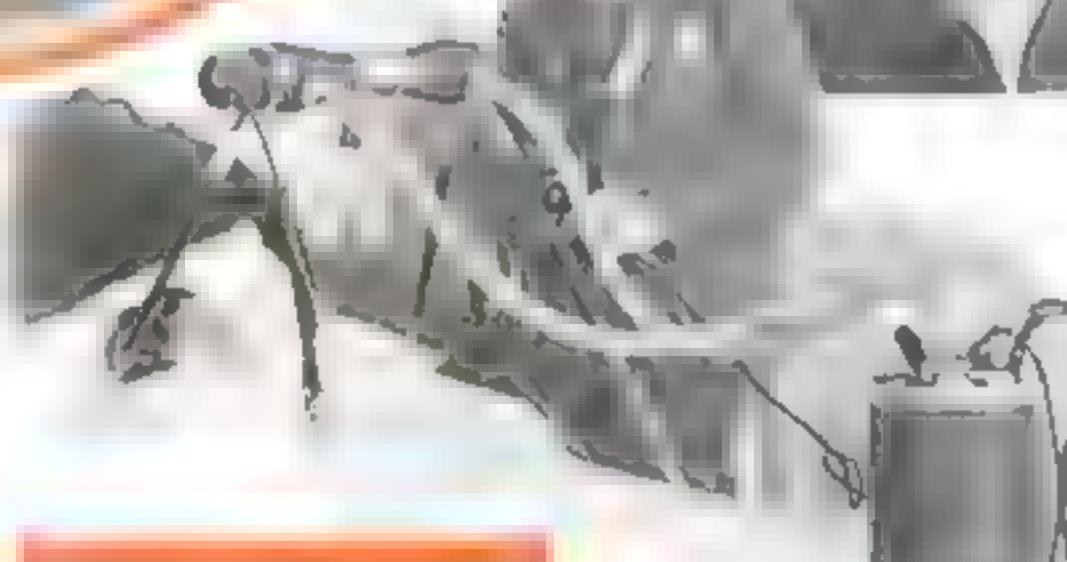
organ is richly supplied with arteries and veins. Recently, however, surgeons have been using the "radio-knife," an electric needle that sears the blood vessels it severs them and thus prevents hemorrhage. These high frequency electric knives cut tissue at a touch. They cauterize leaking arteries and preventing bleeding.

When the thyroid is overactive, its results are almost as disastrous as when it is overactive. The mind slows down until the person becomes practically呆滞的. It has been calculated that three and a half grains a day of the thyroid chemical thyroxin is all that stands between intelligence and imbecility.

I remember one case of a child born with an abnormally large thyroid. Eyes closed and mouth open, driving into the speechless until the age of ten. Her mother, who was supposed to be an actress, took small amounts of the dried thyroid glands of sheep were added to her meal. The effect was miraculous. She brightened up, gained a weight, began to take an interest in play and was soon talking like a child. In school, she passed her examinations easily and is now an intelligent young woman. However, she will always have to continue the treatment. For she tends to gain on occasions when she has tried to do without the dried sheep gland; she has felt her mind becoming dull.

I know an elderly woman, who ten years ago, was literally snatched from death by a physician who diagnosed her trouble as thyroid deficiency. Treatment with thyroxin has made her stronger mentally and physically than she was in her youth.

The chief chemical element in thyroxin, analysis has shown, is iodine. When food



Puppies from the same litter. From one of the pituitary gland has been removed to check its growth. The other grew normally.

or drinking water contains insufficient iodine, thyroid trouble and goiter are likely to develop. This condition is found most frequently in inland communities where fish and other sea-food, the chief food sources of iodine are hard to obtain. Iodine



Picture, left, and above show the removal of the thyroid gland by a surgeon. The pituitary gland, the organ which was previously removed.



is three times more abundant in codfish for example than in human beings.

Travelers in the Italian Alps describe queer people dwelling in the mountain village of Cogne. They are all undersized, pale, and apathetic. Many of them have goiter. Their water supply comes from the melted snow of the mountain tops and it contains no iodine. Recently iodized salt and other forms of iodine which can be assimilated by the system are being used by people in such communities.

Overcoming irregularities of the thyroid leaves only a small part of the work done by the modern gland surgeon. Other phases of his activity are equally strange and dramatic.

Take the operations performed upon the tiny parathyroid glands, minute organs no larger than buckshot. Usually four in number, two on either side of the windpipe, they are so effectively hidden by the thyroid that nobody noticed their existence until 1880. In some mysterious way,

they control the amount of lime in our bones. When these glands become too active, our bones become soft, when they are not active enough, the bones become too brittle.

A few years ago, a sailor was brought to the Massachusetts General Hospital, in Boston suffering from a puzzling malady. In eight years, he had grown seven inches shorter!

Six feet one inch tall in 1918, he was only five feet six inches tall in 1926. He had suffered seven fractures from inconsequential falls and had become so weak he had been obliged to give up his work as a master mariner.

Dr. Edward P. Richardson made an X-ray examination. The pictures showed that the patient's bones were abnormally thin and had lost their lime in many places. His parathyroid glands were overactive. Dr. Richardson removed two of the four organs and the trouble disappeared. The man was able to return to his work and later X rays revealed that the bones had gained a healthy lime deposit. Although he suffered two bad falls subsequently, he had no further fractures.

It often, when very old people fall and break bones, the opposite is really true. A weakened bone snaps and they fall as a result. Middle-aged people and even children are sometimes brittle-boned because of defective functioning of the parathyroids. In Illinois, recently, a man troubled in this way sneezed and snapped a rib and a few weeks ago, a seven-year-old boy was taken to a Madison, Wis., hospital for treatment after he had broken



A frozen block of catgut as it is received in a hospital before being made ready for surgical use. It cannot lose its strength by freezing.

bones twenty-seven times. Every time he fell or bumped into anything, a bone would snap.

In surgical treatment of the parathyroids, extreme care is necessary. Many of the functions of these minute organs are still unsolved. But it is known that if all of them are destroyed, death results within forty-eight hours accompanied by muscular contractions of the jaws resembling the effects of tetanus.

One of the greatest medical discoveries of all time in connection with glands is the application of insulin to the treating of diabetes. Insulin is a product of the

pancreas, a large gland lying behind the stomach. It acts upon the sugar contained in the blood, enabling the body to burn it up and convert it into energy. When the pancreas fails to secrete sufficient insulin, sugar accumulates in the blood and diabetes results.

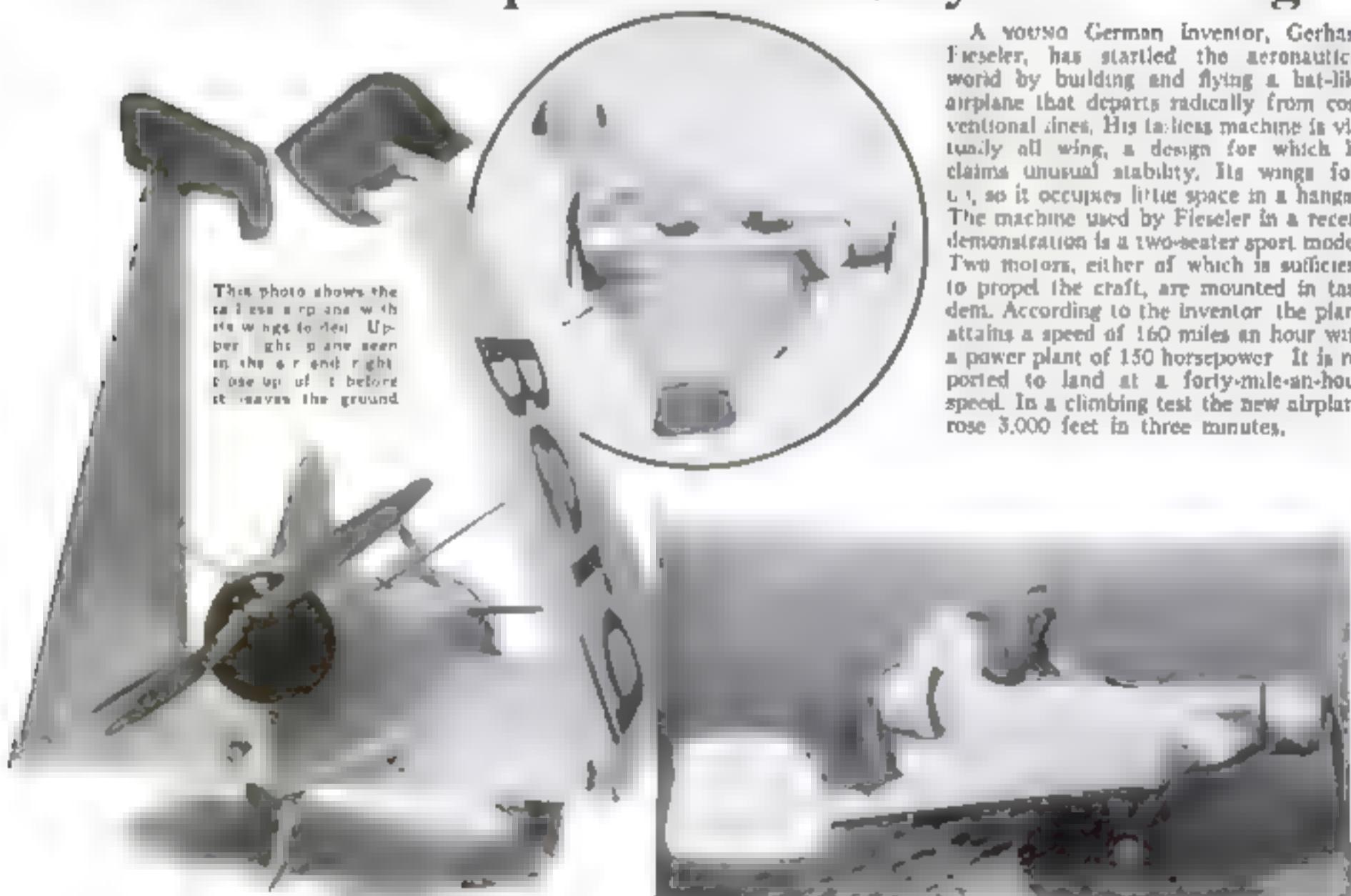
More than a million sufferers in the United States alone are being aided by insulin obtained from the fresh pancreas glands of animals and injected daily through a hypodermic needle to supplement the lowered insulin output of their own systems.

But this life-saving discovery marks only the beginning of the gland specialist's attack upon diabetes. In Chicago, Ill., not long ago, Dr. George De Takats performed a dramatic operation which may lead to conquering diabetes by surgery.

Making an incision in the abdominal wall of a diabetic patient, he pushed the stomach aside and reached the pancreas. Around a portion of this organ, he tied tightly a strip of living membrane taken from the patient's thigh. This constricting loop caused a part of the gland which secretes gastric juices into the small intestines to waste away. Correspondingly, the portion which manufactures the hormone, insulin, grew more active. In this way, the pancreas was stimulated to manufacture its own insulin and reduce the seriousness of the disease. Upon his recovery, the patient found he could eat a far more liberal diet and was able to reduce the amount of insulin taken hypodermically to smaller and smaller doses. In other parts of the

(Continued on page 47)

Bat-Like Airplane Is Nearly All Wing



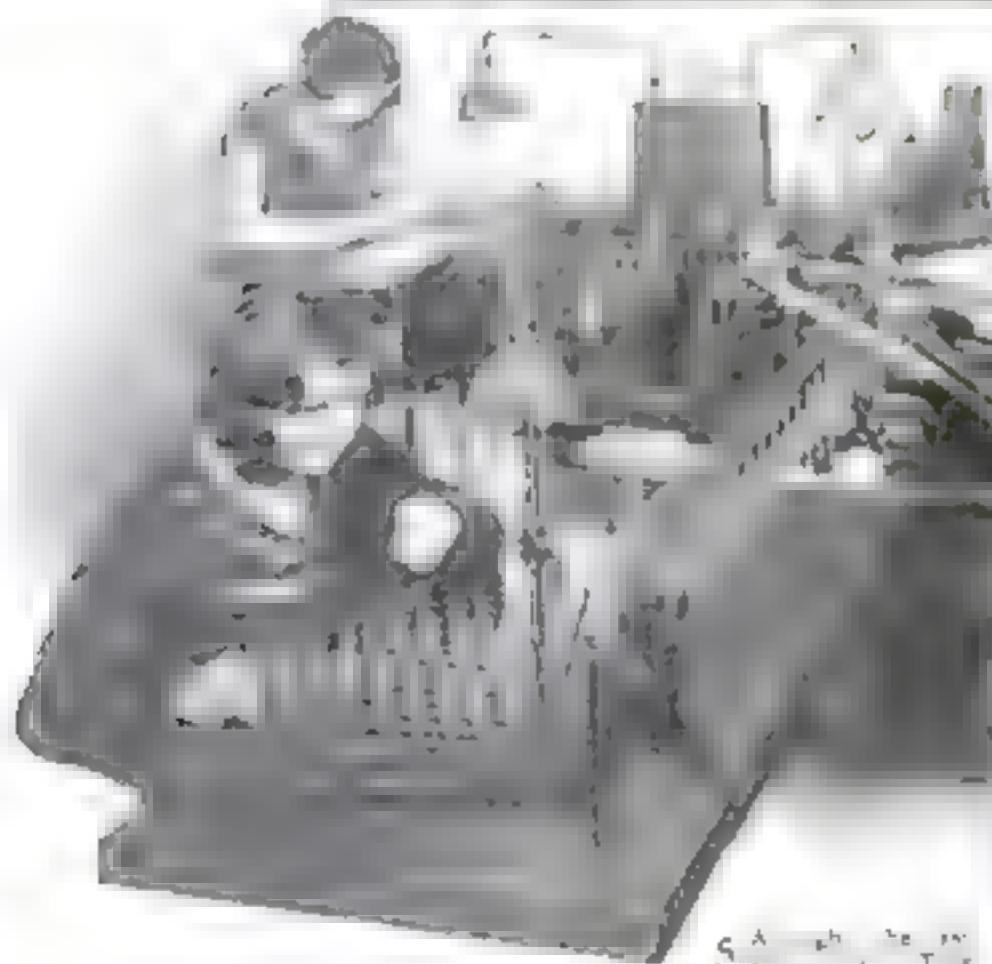
This photo shows the Fieseler air plane with its wings folded. Upper right shows seen in the center right pose up of it before it leaves the ground.

A young German inventor, Gerhard Fieseler, has startled the aeronautical world by building and flying a bat-like airplane that departs radically from conventional lines. His tailless machine is virtually all wing, a design for which he claims unusual stability. Its wings fold up, so it occupies little space in a hangar. The machine used by Fieseler in a recent demonstration is a two-seater sport model. Two motors, either of which is sufficient to propel the craft, are mounted in tandem. According to the inventor the plane attains a speed of 160 miles an hour with a power plant of 150 horsepower. It is reported to land at a forty-mile-an-hour speed. In a climbing test the new airplane rose 3,000 feet in three minutes.

How Light Bulbs Are Made



2 **11c** **1** **2** **3** **4** **5** **6** **7** **8** **9** **10** **11** **12**



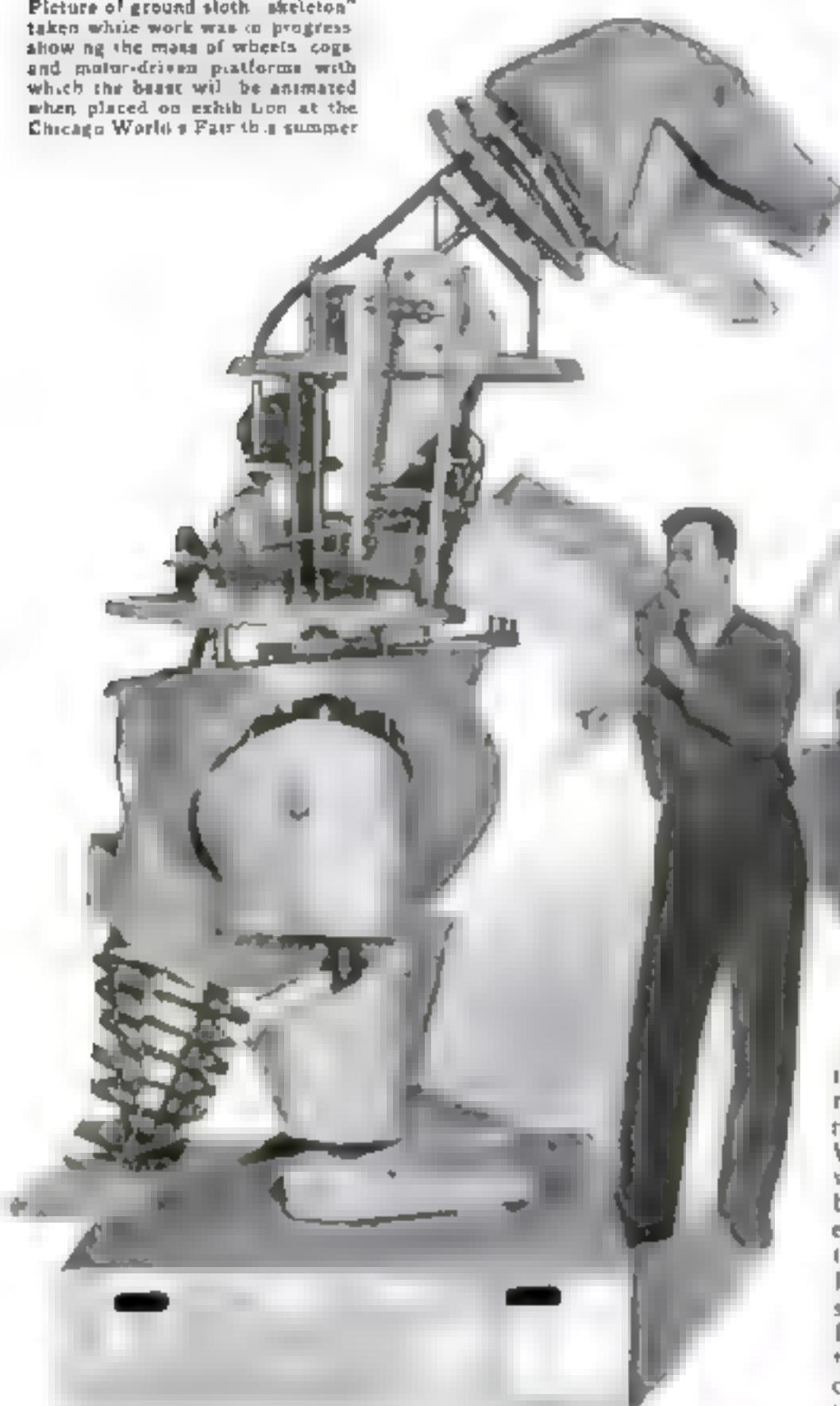
4 The case which has been made
by the author seems to me to be
the least we can do for the K.
place where he has been - the K.
necessary to give him a hearing as his case is

S	A	R	H	E	P
s	a	r	h	e	p



Hidden Motors Give Life to Prehistoric Monsters

Picture of ground sloth "skeleton" taken while work was in progress showing the mass of wheels, cogs, and motor-driven platforms with which the beast will be animated when placed on exhibition at the Chicago World's Fair this summer.



A jungle scene from big-back ground for the animated prehistoric monsters. Note how the domed roof above the elephant.



At left a real skin covering is being put on the form of a saber-toothed tiger, another of the ancient animals that will be shown at Chicago Fair.

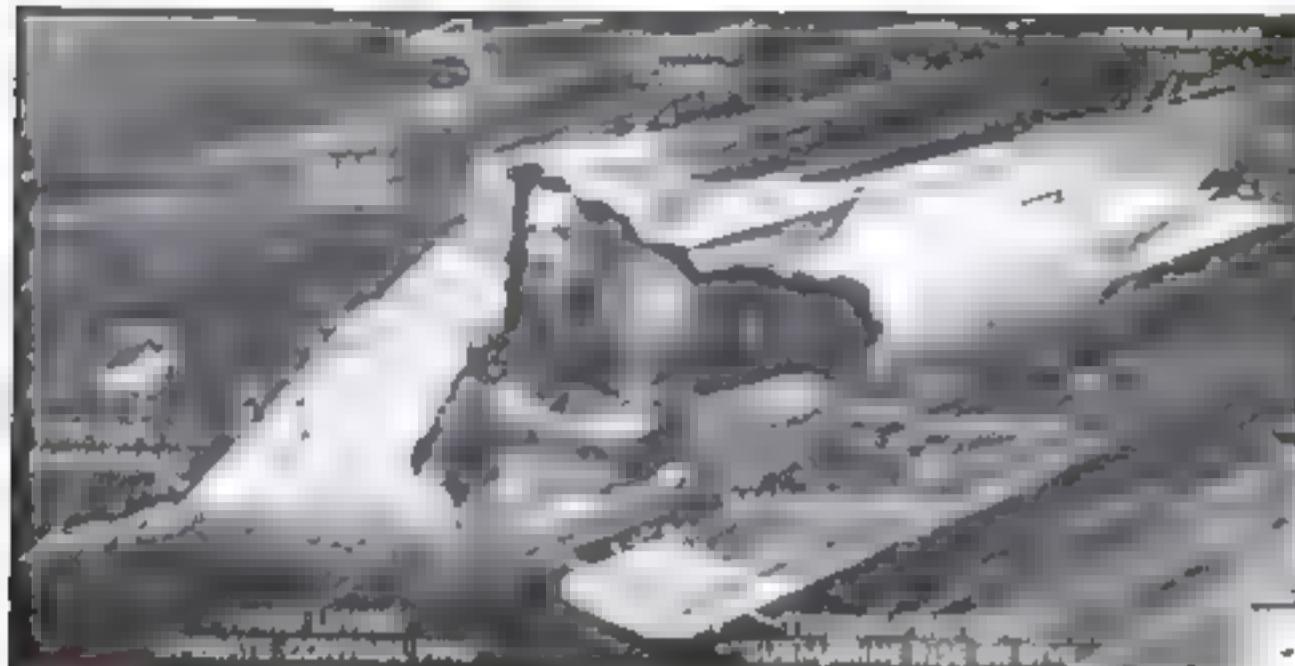
SABER-TOOTHED tigers, giant ground sloths, and dinosaurs, inhabitants of the earth millions of years ago, have been reproduced mechanically by the New York firm of Messmore and Damon for exhibition this summer at the Chicago World's Fair. Within a huge hemisphere of metal, they will give visitors a glimpse of the world as it was long before man appeared. (P.S.M., June '32, p. 16.) Controlled electrically, the mechanical monsters swing their heads, roll their eyes, breathe, snarl, roar, and grunt in realistic fashion. A complicated mass of cogs, wheels, belts, and silent motors produces the life-like sounds and motions. Beneath the canvas and papier-mâché hide of each animal there are from one to sixteen electric motors. An operator controls the actions of the exhibits. At the World's Fair they will be seen in an environment of prehistoric vegetation.

SECRET OF SPONTANEOUS HAY FIRES IS SOUGHT

SEEKING to solve the mysteries of spontaneous combustion the U. S. Department of Agriculture is using a special core drill shown at the right, and twenty-seven electric thermometers to keep constant tab on temperature changes in an experimental haymow at Beltsville. Mid Samples of the hay are taken with the hollow motor-driven drill and twice a day the temperature of the hay at twenty-seven different points, is taken with the thermometers. Records of the heat developed by hay under varying conditions are expected to help in preventing fires that start themselves. At present, the Department of Agriculture reports, one out of every ten tons of hay cut in the United States is destroyed by spontaneous combustion due to storage under unsatisfactory conditions.



Inventor Gets Thrill in Homemade Submarine



Cutaway drawing of one-man submarine showing how the occupant lies flat with his head in the conning tower while the submerged craft is being towed slowly by a motorboat.

His own invention, a one-man submarine, provides thrills for twenty-four-year-old James Bolar, Jr., of Oakland, Calif. He built the ten-foot craft in the basement of his home at a total cost of fifteen dollars for materials and demonstrated it recently to astonished spectators in San Francisco Bay. Bolar enters a hinged conning tower which is then sealed watertight by a rubber flap, and lies flat on the floor. A speedboat takes him in tow. When he wishes to submerge, hand levers tilt a pair of diving fins that work independently, one on each side. Through a heavy plate glass window he can see twenty feet ahead while being towed at slow speed. Perforations in the false bottom of the streamlined shell admit water to a ballast tank, reducing buoyancy. Bolar has sub-

merged to depths of thirty feet, and has remained below the surface for half an hour without discomfort. He suggests possible uses for his craft, aside from sport, in hunting for sunken vessels and surveying harbor bottoms or studying lake beds.



Below, the Inventor of the new sub peering from the conning tower, the top of which is raised. At bottom, a motorboat with the sub in tow. It can be dragged at thirty miles an hour on surface and at half that speed when it is to stay submerged.



POISON GAS FOR LOCUSTS

Fascinating plagues of locusts with poison gas, sprayed from airplanes, is proposed by British scientists. Four crates were recently shipped from Kenya, Africa, by air to London, England, where they are being carefully reared in breeding cages. They will be subjected to poison fumes to learn which vapors are most effective.



Live locusts, shipped by air from Kenya, Africa, are being carefully inspected before they are put in the electrically heated breeding cages right for further growth.



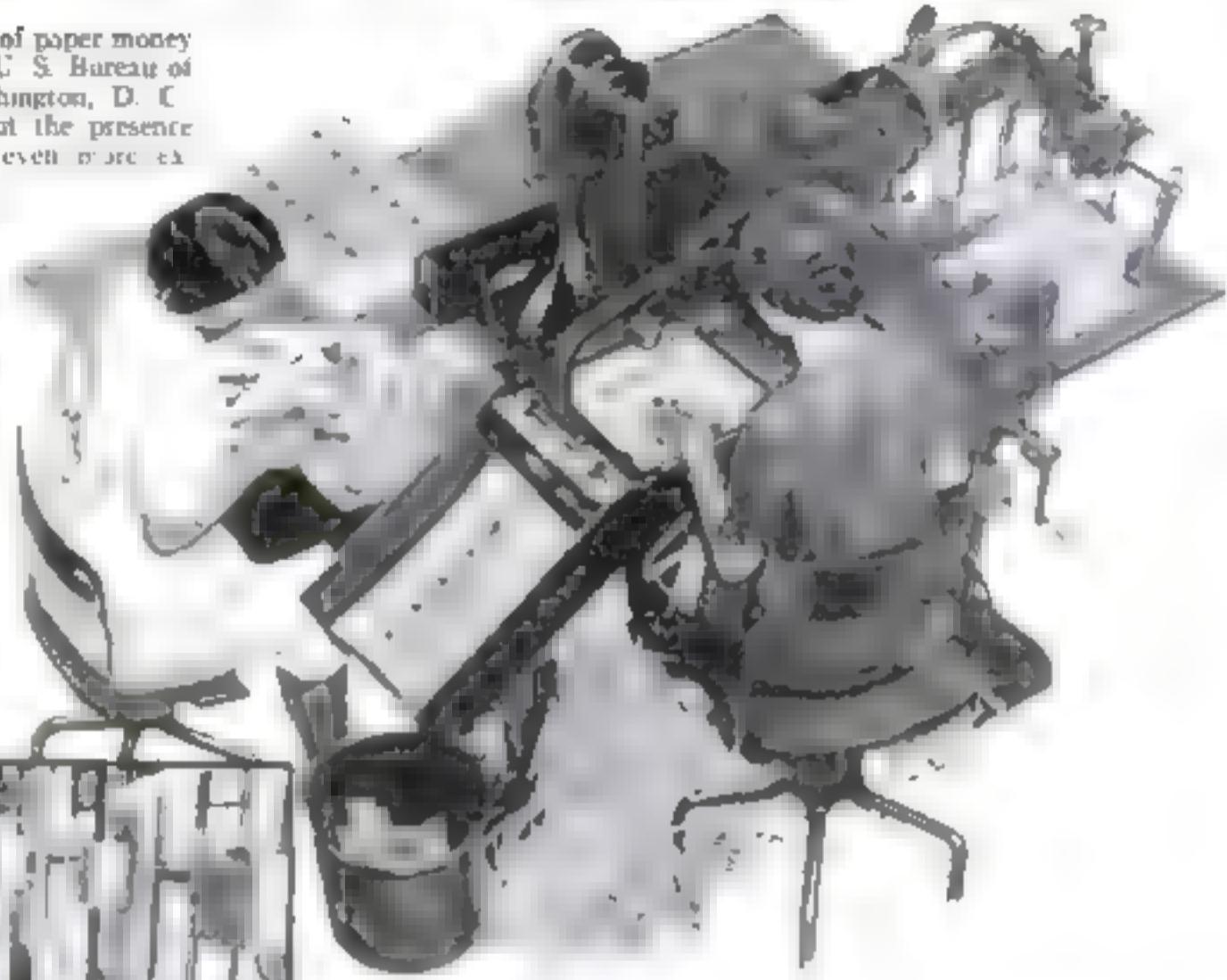
PICTURES ILLUSTRATE NEW BOOK FOR BLIND

ILLUSTRATIONS with raised dots appear in the first practical picture book for blind children, recently issued. By running a fingertip over the outline of the picture, which resembles the dotted texture of Braille writing, it is possible to comprehend the form. The pictures, one is seen above, are colored.

Camera Catches Uncle Sam Making Billions of Dollars

PRINTING \$2,000,000,000 worth of paper money gave the 5,000 employees of the U. S. Bureau of Printing and Engraving at Washington, D. C. a rush job a few weeks ago—but the presence there of photographers was an even more extraordinary event. Special permission was granted by the U. S. Secret Service for them to take pictures of the making of bills and two of the unusual views are reproduced here.

Even in a normal year Uncle Sam's money factory turns out enough paper currency to encircle the earth four times. Every sheet of the special paper used must be accounted for. When not in use the dies used in printing the bills are stored in a vault surrounded with mirrors so a guard can inspect the whole chamber at a glance. Electric alarms connect the vault with police headquarters and Army posts.



Printed in sheets of twelve U. S. banknotes come to this trimming machine. There probably fingers beside the sheets and know from the edges. Then the裁 are cut again.

At left are a few of the 240 present-day print papers made for Uncle Sam. Each one or over a sheet of twelve notes which are ready to go to the printer every five seconds.

SELF-LIGHTING CAMERA NOW USED IN MOVIES

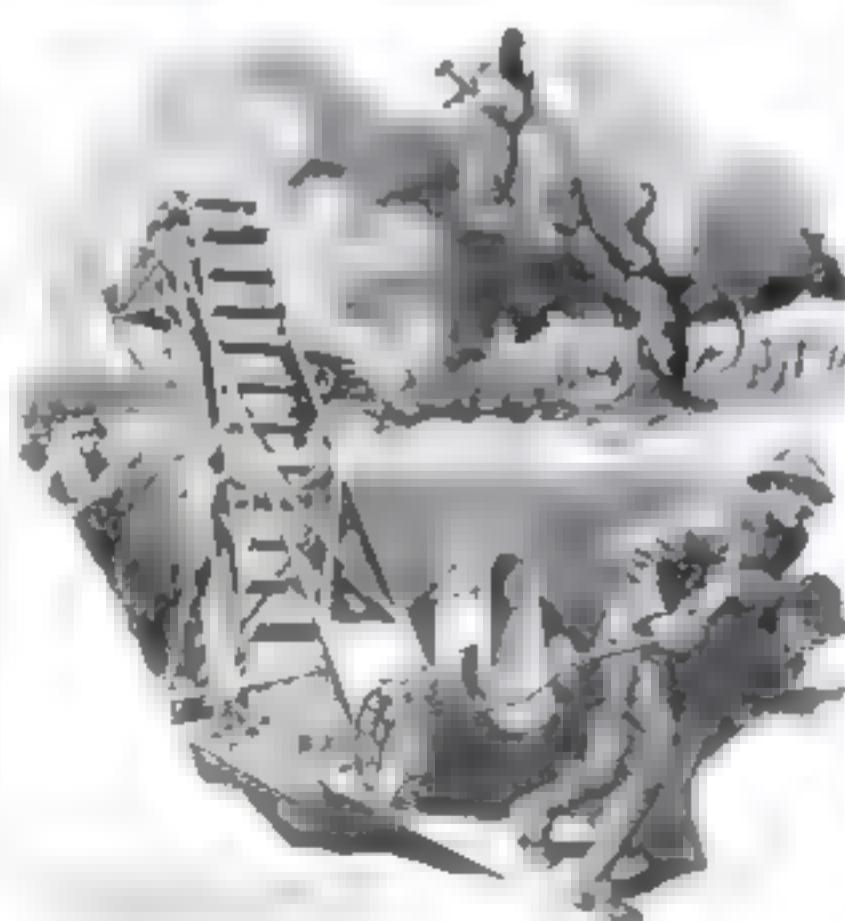
A studio camera that produces its own light is a recent innovation in a Hollywood, Calif., studio. It carries a detachable lamp with a 300-watt tubular frosted bulb upon a bracket at the front. In this way a continuous light is thrown on the face of an actress while the camera is moved around her for a close-up.



This new movie camera carries its own light which is supplied by a 300-watt tubular bulb.

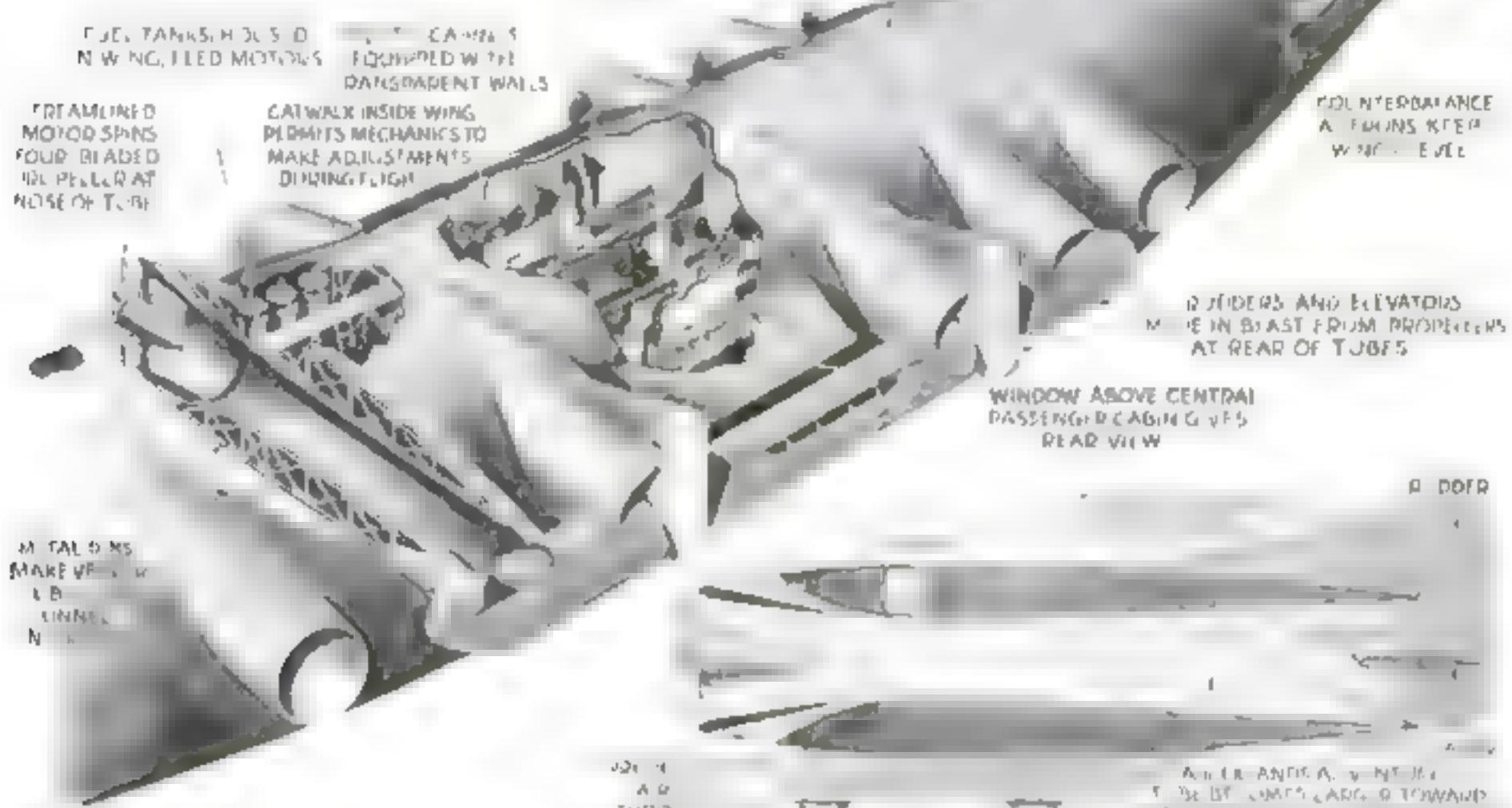
ONE MAN RUNS NEW TRENCH DIGGER

By adding an endless conveyor to a gasoline driven cultivator of standard design, a Long Island City, N. Y., inventor has devised a one-man trench digger for military use. Soldiers equipped with these machines, he says could dig themselves into an advanced position while under withering fire from the enemy lines. The space between opposing armies would specially be transformed from an impassable No Man's Land to a labyrinth of lanes. For the digging unit, the inventor employs a type of revolving cultivator widely used for tilling farm soil. Motor-driven tines kick up the earth, depositing it on the conveyor to be dumped at one side. The trench digger can be operated by one man.



Huge Barrel Plane for Ocean Flights

Air Tunnels in Giant Flying Wing Expected To Increase Power of its Many Propellers



PIERCED by a battery of tunnels a flying wing airplane is proposed by an engineer at the famous Caproni airplane works in Italy. Streamlined motors and four-bladed propellers will drive air blasts through the tunnels, each of which forms a Venturi tube, expanding toward the rear. Thus, according to the inventor, the air will give a forward push something in the manner of rocket propulsion. Aided by the Italian government, the de-

signer recently completed a single-engined experimental craft incorporating his ideas. This odd flying barrel was put through successful tests near Rome. (P.S.M., Jan. 13, p. 18.) Details of the huge machine he proposes to build for transatlantic travel are shown in the pictures above. A half-dozen tunnels or more will run through the immense flying wing. Rudders and elevators will be mounted so they will move in the blasts issuing from

the tubes. The craft will be piloted from a cabin with transparent walls at the center of the leading edge of the wing. On either side will be observation bays from which passengers can look ahead. Other windows will afford a rear view from the central passenger's cabin. Another feature of the machine will be a catwalk running lengthwise through the wing. It will enable mechanics to make adjustments while the plane is in flight.

MODEL OF ROME IN 100 PARTS

LIKE fitting together a mobster jigsaw puzzle is the task of assembling the sections of an immense model of ancient Rome which has just been presented to the Pennsylvania Museum of Art at Philadelphia. It is composed of about 100 sections, and covers an area thirty feet long and twenty-one feet wide. It was executed by Paul Bigot, noted architect and archaeologist. The illustration at right shows the model taking shape in the museum where it will illustrate the architecture of the old city.



How to with a



• Manner of Making a Simple Astronomical Instrument and a Perpetual Map of the Sky Is Explained in Detail in This Article for Amateurs

By GAYLORD JOHNSON

KNOWLEDGE of the principal star groups precedes any real pleasure in stargazing.

When you can recognize at a glance about two dozen groupings that contain important stars, you have learned the geography of the sky. You can then wander in skyland at will, and explain its points of interest to others. You can indicate the brightest of the sparkling stars and say "There is Arcturus. There is Vega, and there are the Guards, the two stars that Columbus sailed by when he discovered the New World."

Knowing the stars by name, you will welcome the reappearance of characteristic spring star groups as heartily as you welcome budding trees and milder days. You will soon look upon these strangely imagined star animals and people as old fam. or friends that can always be found in their expected places.

Nearly every one has at least two friends among the stars—the "big dipper" and the "polestar." In the last article I told how to tell time by following the twenty-four-hour rotation of the dipper around the pole. Now we shall start with

the umbrella, on which you have chalked a few stars, and show the principal star groups that are visible at the different seasons. Then we shall invent a simple device that will enable us to find these stars at any time of the year.

A glance at the two pictures of the umbrella shown makes it plain that the nine o'clock appearance of the northern sky changes from season to season.

Look closer and you will see that the big dipper rotates through a quarter turn around the polestar in three months. Also you will see that the four main groups around the polestar can be joined by two lines crossing at right angles.

A line from the dipper crosses the pole and meets a sprawling "W" or "M" about the same distance on the other side. This "W" group is Cassiopeia.

The other line, crossing the first at right angles, runs from a small group at the east of the pole, containing the single bright star, Vega, to a group of five west of the pole. These five form the constellation Auriga. The brightest of them is a brilliant yellow-white sun named Capella.

These four are for each season, con-

stitute our key groups. Using them as landmarks, we can find all the star groups at any time of the year for some one of them is always in a good position from which to run lines that will help us find the other constellations of the season.

Notice in the illustrations that both the dipper and the W are cut by the third short white parallel line, counting from the pole. Each of the spaces between these short lines, extending along our umbrella's ribs from side to side, represents ten degrees. The dipper and the W are each therefore about thirty degrees from the pole. It takes six more divisions to reach the edge of the umbrella—ninety degrees in all from the pole of our miniature sky to its equator.

At this point you may ask, why can't we make a measuring rule marked off in degrees, hold it up toward the real sky and thus find all the other principal stars by their distance in degrees from the pole and from each other? We can. That is just what we are going to do, but first we must know the length of a degree.

Here is a simple rule that tells us exactly what we want to know. Any round

object, like a penny above, held at fifty-seven times its diameter from the eye will occupy an angle of just exactly one degree.

Two rows of stars, or a portion of a map, may be divided into six equal segments, each of which contains one degree.

Two rows of stars, or a portion of a map, may be divided into six equal segments, each of which contains one degree.

Find the STARS

Crossbow



How You Can Find the Important Spring and Summer Star Groups in Northern Hemisphere

A To find Alcyone, imagine the curving handle of the dipper to be more than longer. Place the end of the bow ruler on the star at the handle, with the ruler extended along the handle. At thirty degrees along the ruler you will find Alcyone.

B To find Regulus, in the Leon hold the bow along a line joining the two stars on the side of the dipper next the handle. Place the end of the ruler at the star where

hand & joins bow. The ruler will point out a bright star fifty degrees from the dipper. This is Regulus.

C To find the Guards extend the line above the bowl of the dipper. Place the ruler along this line with end at star where handle joins bowl. Twenty-two deg res above the dipper are the sought-for Guards.

D To find Castor and Pollux extend the line of the dipper's han-

dle through the star diagonally across the bowl. Hold end of ruler on this star and continue line fifty-two degrees at which point are twins.

E To find Procyon, extend the line used to find Castor and Pollux twenty degrees beyond them to two more stars. The brighter is Procyon.

F To find Altair, hold the ruler along a line from the star where the dipper's handle joins the bowl.

At thirty-five degrees along this line beyond Vega you will find Altair.

G To find Deneb, extend the line used in finding the Guards on beyond those stars. At forty-five degrees farther along you find Deneb.

H To find Square of Pegasus, extend the line from dipper's pointer to the polestar. At forty deg res beyond the pole you find four bright stars and at that side is the Square.

object held at fifty-seven times its own diameter from the eye, occupies an angle of one degree. You can use a button, a coin or a larger plate.

Take a copper cent and measure its diameter. It is exactly three-fourths of an inch. How far must it be held from the eye to occupy an angle of one degree? Obviously, fifty-seven times three-fourths or forty-two and three-fourths inches.

To get a satisfactory measuring rod, hold a two-foot ruler at such a distance from the eye that each one-half inch division will occupy the angle of one degree. To do this the ruler must be held fifty-seven times one-half inch, or twenty-eight and one-half inches, from the eye.

If we do this with a straight ruler, however, it is obvious that the divisions at the ruler's ends will be more than twenty-eight and one-half inches from the eye. To correct this error we must bend the two-foot rule into a bow and fasten it by its center to a stick that is twenty-eight and one-half inches long. Then we shall be able to measure forty-eight one-half inch degrees in any direction on the curving bowl of the sky. With it, you can find the angular distance between any two stars, just as a ship captain does with his sextant.

To use your instrument, rest the bottom end of the stick upon the cheek bone

below your eye, place one end of the bow ruler on one of the stars, and read off the point where the other star touches the ruler. The observer in the illustration is using his crossbow to measure the number of degrees between the star where the dipper's handle joins the bowl and the pair of stars called the Guards. With the end of the bow ruler at the star in the dipper, the Guards fall at a point about twenty-two degrees along the edge of the ruler. This corresponds to twenty-two half-inches or eleven inches on the curved bow ruler.

In making my instrument, I used an ordinary hardware store yardstick and a half-inch dowel rod. In order to see the divisions, when the bow ruler is held up against the sky, I notched its edge at two and one-half inch intervals. If I want a more precise measurement I turn on a flashlight and note the exact half-inch division where the star touches the edge.

At nine p. m., about the first of May the dipper is above the pole with Vega almost straight east of it. About the first of August, at the same hour, the dipper hangs down at the left of the pole, with Vega high above it.

During May, June, and July, Vega and the dipper are excellent finger posts for finding all the other principal stars of the

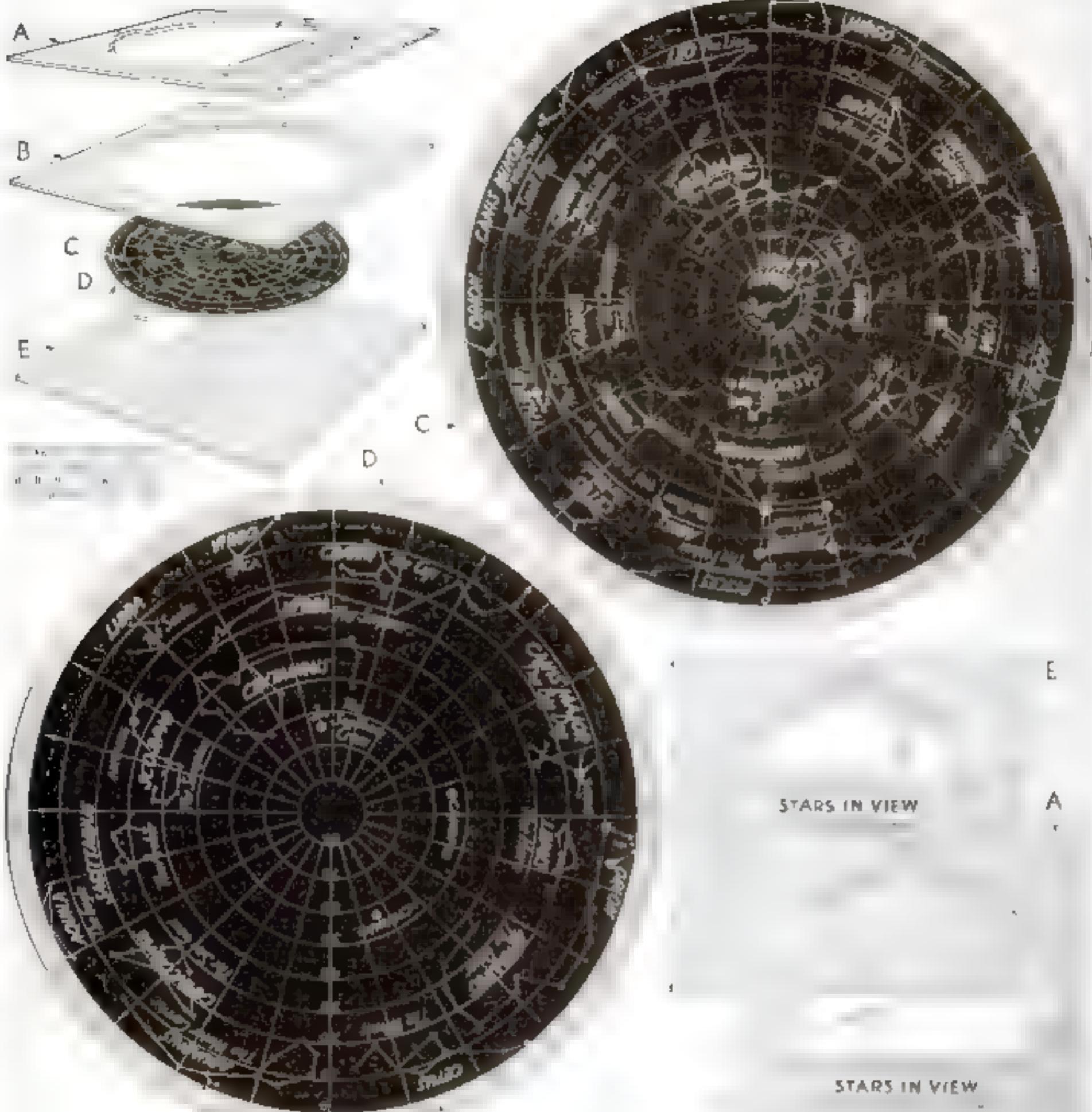
early summer sky. Now with the aid of your crossbow you are ready to go out and find a few stars.

If you read over the series of six paragraphs, lettered A, B, C, etc., and look at the dotted lines lettered to correspond in the other illustrations, you will know exactly how to use your bow ruler in finding each star. Then, if you have chalked upon your umbrella the necessary lettered and numbered lines, you can take it out and use it as a memorandum of directions and distances, to be consulted with the aid of your flashlight.

It is easy to make a two-faced star chart that will show on one side the constellations in view in the Northern Hemisphere of the sky at a certain hour in the evening, and on the other side the groups to be seen at the same time south of the sky's equator.

To do this, take a piece of heavy cardboard thirteen inches square. Cut from its center a perfectly circular piece ten inches in diameter.

Then, using a compass and straightedge, enlarge the circular plans shown on page 44 to nine and one-fourth inches in diameter, exclusive of lettering around edge. The radial lines are sixty degrees apart. Divide the radius into nine equal parts and describe concentric circles. It is then



an easy matter to locate the stars and constellations on your charts by reference to the diagrams. The charts shown here were made on black paper with white ink, but black lettering on white paper is equally effective. If you live in a city and do not wish to go to the trouble of enlarging the charts, you can take the page from this magazine to an office that makes photostat prints and have both plans enlarged to ten-inch circles for about a dollar (See note on opposite page.)

When your two circular plans are enlarged glue them firmly to the two sides of the ten-inch disk. Make sure that the month names and their corresponding lines are exactly opposite. When the disk is complete, replace it in the hole from which it was cut. Sandpaper the edges.

Permanent Star Maps of Principal Groupings

The diagrams above and at right show how to make a two-faced star chart containing on one side the stars of the Northern Hemisphere and on the other the stars south of the sky's equator. Complete directions for cutting the dia, disk and frames and to accurately locating the stars on the charts are given on this page. Frames and disk can be cut from cardboard in the dimensions indicated, although a more durable map, of course, can be constructed of plywood, thick celluloid, or other like material.

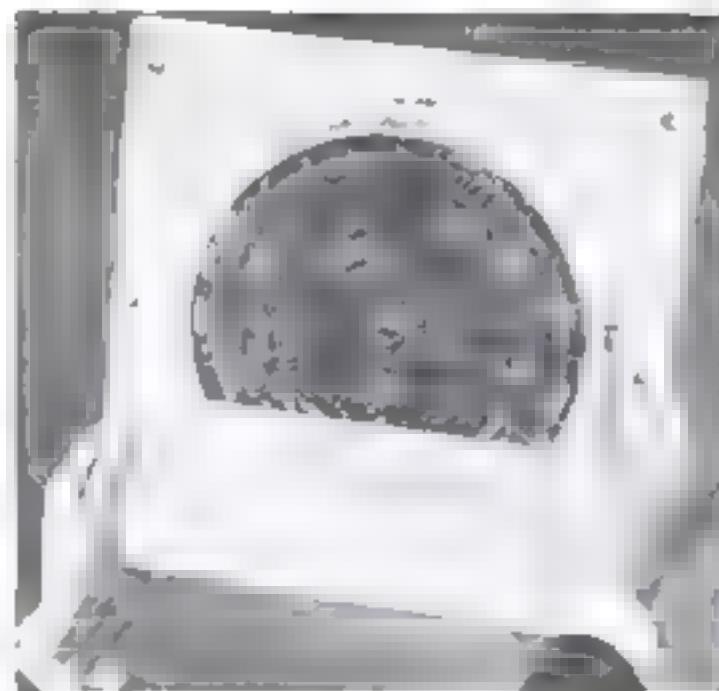
From strong cardboard make the two square masks shown in the small drawings and glue them to the square frame of cardboard from which you cut the disk with the curved sides of the mask openings toward the top. Glue the mask which has the larger opening over the face of

the disk on which the big draper and northern polar star appear. The parts may also be fastened together with clips or by binding their edges with adhesive tape. Cut recesses at the top of the masks as shown in the small drawings so that the time of month will be visible on the disk containing the star charts also cut openings at the sides of the masks and in each frame so you can turn the dia.

The two masks now hold the disk in place yet allow it to revolve freely. As it turns, the fourth circles from the north and south poles should just touch the horizon lines. This applies to all places near the latitude of New York City that is forty degrees, north. In making the

star map for a place ten degrees north of this the mask opening having the northern horizon line must be extended downward until the horizon line touches the fifth circle below the north pole but the bottom edge of the mask opening having the southern horizon must be cut higher I should just touch the fifth circle above the south pole at the sky. Opposite changes must be made for a place ten degrees south of the latitude of New York City.

When your star chart is finished, turn the disk slowly with thumb and finger, and you will see the stars in view at nine o'clock at intervals of two weeks throughout the year. Note that we see more of the northern half of the sky than we do the southern. At the north pole we should see only the Northern Hemisphere with the pole star straight overhead. At the equator we should see northern and southern halves of the sky equally with the north pole star on the northern horizon, and the faint south pole star Sigma Octantis on the southern horizon. The best



How to Get Star Charts

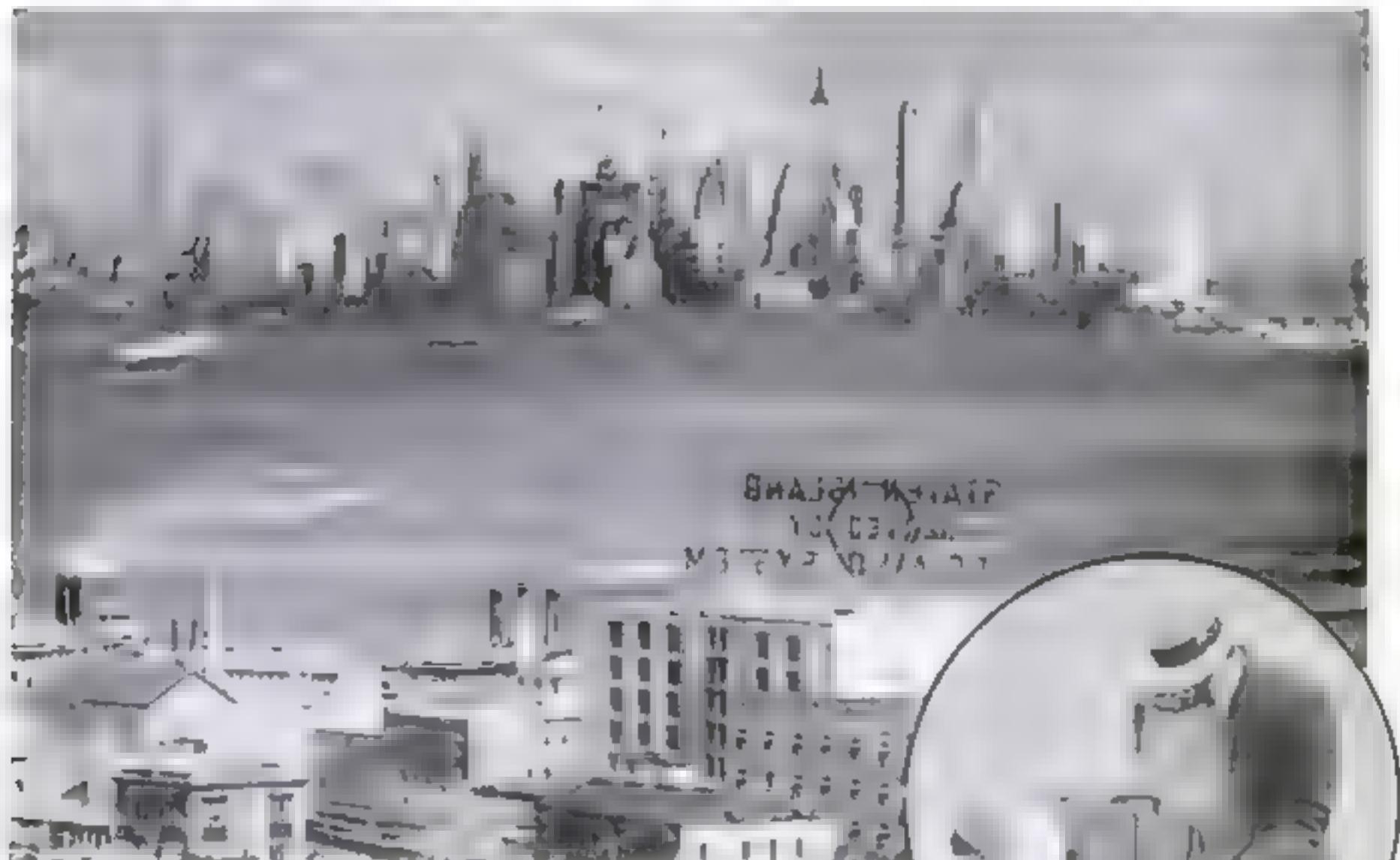
HE'RE is the way your perpetual star chart will look when completed. For the readers who may not wish to go to the trouble of enlarging the charts from the illustrations on the opposite page, Popular Science Monthly has prepared this red reproduction of them. These with directions for preparing the frames will be sent to any address on receipt of 25 cents. Print name and address and send your order to Blueprint Department, Popular Science Monthly, 331 Fourth Avenue, New York City.

of Orion which is almost exactly on the equator of the sky would then pass over our heads during winter nights.

Now that you have learned to know some of the sky countries by sight, you are ready to get your first thrill from seeing through a magnifying glass of moderate power some of their principal points of interest. The next article will give you the high spots of Opera Glass Astronomy. You will be surprised at how much you can see through a binocular magnifying ten times, or even through an opera glass magnifying three or four times.

The great Galileo proved his theories and revolutionized the accepted ideas of the universe with the aid of a rude telescope that was no more powerful than is one tube of a modern opera glass. As I have said in earlier articles, amateur equipment is by no means essential to understanding and enjoying the grandeur of the heavens nature's greatest show. Indeed important discoveries in astronomy have been made with just the kind of simple equipment I have described.

Airplane Camera, on Ground, Takes Pictures of Invisible Things



OBJECTS so far away they can not be seen are revealed by the latest news photographers—a camera that cuts through haze with special filters and plates sensitized to infrared rays. Originally developed for long-range aerial photog-

raphy, it is now being used to take striking examples of city skyline views over water. The Empire State Building is nearly nine miles away.

Great Men of Korea Ride Safely on One Wheel

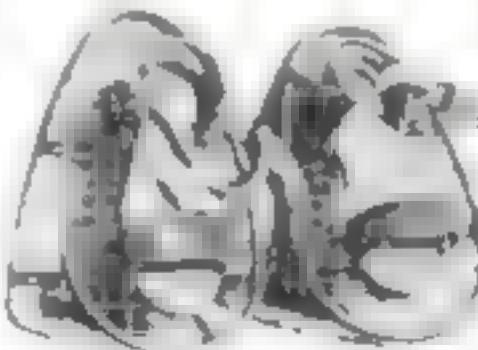


Riding on one wheel may convey an impression of reckless driving, but it is a slow and stately form of locomotion in the Asiatic land of Chosen (Korea). When a dignitary prepares for a trip, he dons a costume that properly reflects his power and prestige, and mounts a vehicle like the curious single-wheeled carriage pictured here. Four strong coolies seize the guiding bars and trundle him toward his destination. Judging from appearances the passenger must necessarily be resigned to a certain amount of rather rough joggling.



WIRE SHOES FOR OYSTERMEN

RESISTING snowshoes in an abbreviated form, shoes of wire latticework have been invented by J. J. Brenner, of Olympia, Wash., for use by oystermen. Ordinarily the soft bottom of the oyster grounds does not readily support a man's weight and he is likely to sink in at each step. This not only makes walking difficult, but also forces small oysters into the bottom where they become covered with silt and die. Use of the new footgear is expected to end the loss of oysters from bay areas.



Wire shoes are worn by oystermen to keep them from sinking in silt. Left, view of wire network construct on

DIAL CHECKS UP IGNITION

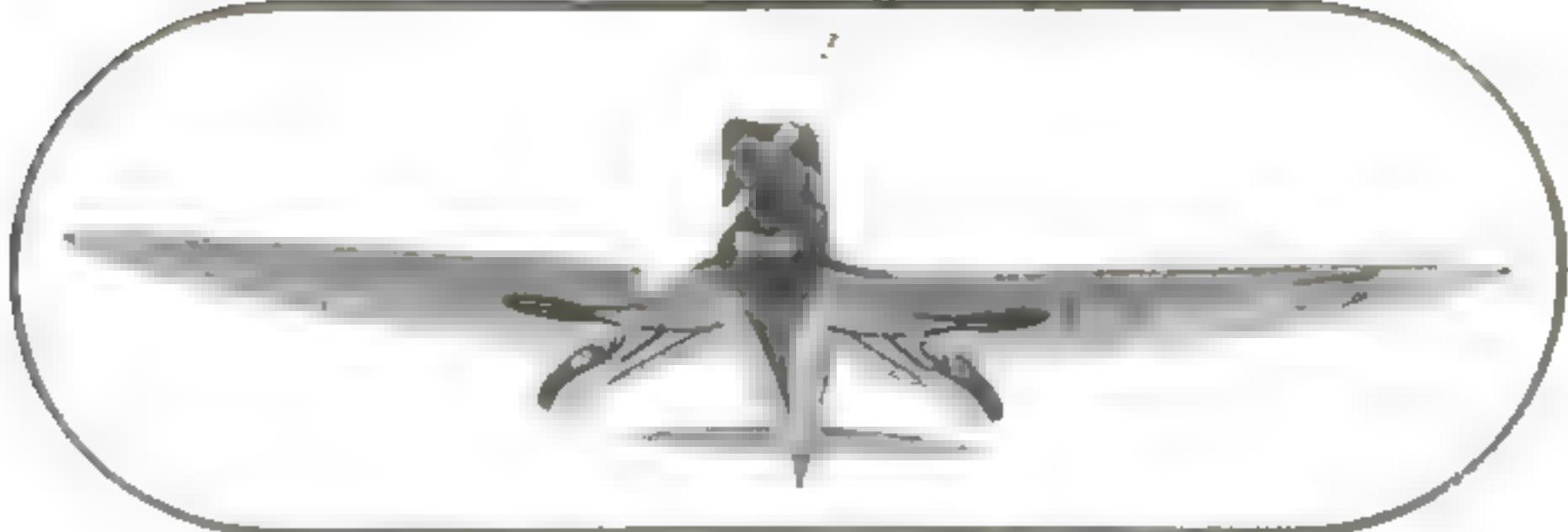
WHETHER YOUR car's ignition is working properly is revealed at a glance by a new device on the left, the steering post, shown above. When each spark plug fires, a blue spark is seen in a numbered window of the fireproof dial. A dark window shows that a cylinder is missing fire and the number indicates which one, permitting quick repair and preventing overheating and fuel waste. Special spark plugs, upper right, have terminals for wires leading to dial.



PERISCOPE ON GOLF COURSE GIVES VIEW OVER LOW HILL

PROBABLY one of the most unusual golf devices in the world is on a Canadian course at Victoria, B.C. A small hill rises between the ninth and tenth holes, making it impossible for a golfer to see where to aim his ball. To remedy this difficulty, a periscope approximately twelve feet in height has been erected at the ninth hole, as illustrated at right. Before driving toward the hidden hole a player gets his bearings by looking over the hill through the periscope.





Landing Wheels Vanish into Plane's Wings During Flight

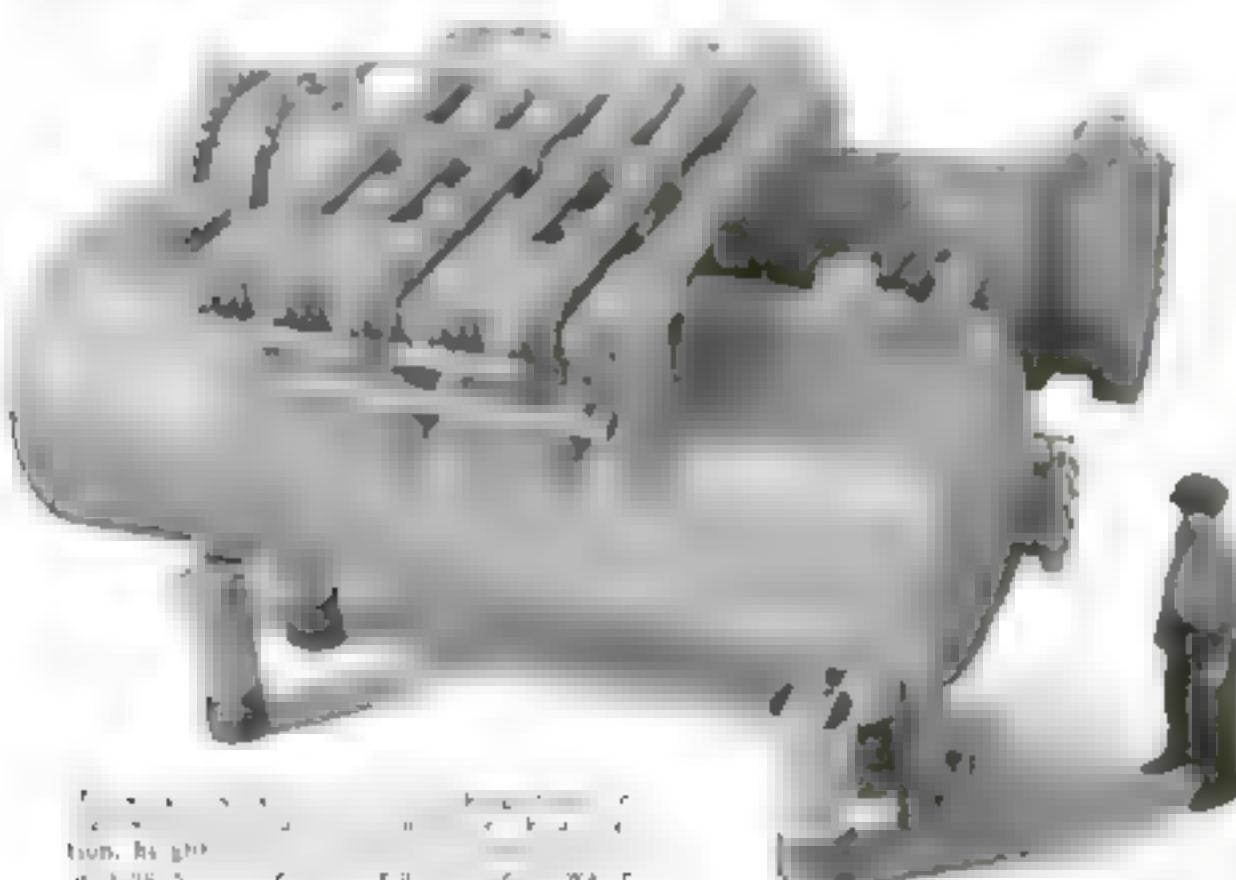
How modern planes increase their speed by withdrawing wheels into wings, after the take-off, is strikingly illustrated above. The photographer snapped a new

German craft soaring overhead at the moment the pilot was operating the retractile gear of the latest type. The wheels are seen about to disappear into

holes in the wings, which are then closed by plates. When the wheels are let down for a landing, the hinged cover plate swings sideways to clear the ground.

NEW ELECTRIC FAN HAS RIBBONS FOR BLADES

WHIRLING loops of ribbon replace metal blades in an accident-proof electric fan recently exhibited by a German Inventor and illustrated below. Since there is no danger that the user may suffer a cut hand by reaching toward it in the dark, the fan is especially recommended for bedside use. Revolving on a shell around the tiny motor, the three tabs of ribbon provide a gentle circulation of air.



HOT STEAM COOLS DRINKING WATER

Using hot steam to chill drinking water is the feat that will be performed in a New York bank building by the 180-ton outfit illustrated above. Water sprayed into the front tank cools itself by its own evaporation, which is greatly accelerated

by a high vacuum maintained throughout the apparatus. This vacuum is produced by allowing steam to condense in the rear tank. Part of the chilled water is drawn off for drinking, while the rest is run through pipes to cool the building.

LAWNMOWER CUTS UPSIDE DOWN

A LAWNMOWER that runs in reverse has recently been placed on the market. Normally it is pushed but a special frame permits it to be used upside down for trimming under shrubbery. The cutters will then revolve only when the mower is drawn toward the operator. Terraces may be trimmed from below in the same way. The height of cutting is adjustable from one-half to three inches, to suit the condition of the lawn, by a ratchet lever on the handle, as shown at left.



PLUG CLEANS OIL IN CRANKCASE

MOTORISTS are now offered a magnetic drain plug that abstracts foreign particles of metal from oil circulating in the crankcase, reducing wear on a car's motor. When oil is drained, the metal may be brushed off the plug. It is shown, left, before installation, and, above, after several hundred miles' driving. The pole pieces are permanently magnetized.



COLLECTING NITROGEN

The apparatus shown here is used to get nitrogen from ammonia. Copper fly screening, cut up, is placed inside the short iron pipe. A tube from the ammonia generator leads into the pipe and an outlet tube leads from the other end to a bottle filled with water in which a bubble of water is inverted. Heating pipe and then flask removes hydrogen in pipe while nitrogen enters the bottle.



Surprising Tests WITH Household AMMONIA



By carefully adding water to a mixture of ammonia in gas and zinc dust you can produce a spontaneous flame. As the water is added, as shown, the mixture bubbles, smokes and burns.

IT IS surprising what the amateur chemist can do with a fifteen-cent bottle of ordinary household ammonia.

Being a mixture of ammonia dissolved in water, this pungent-smelling liquid offers an ever-ready supply of ammonia gas for the home laboratory. Even at room temperature, the gas is released from the liquid. By heating it, the experimenter can obtain the gas in larger quantities.

Strictly speaking, household ammonia is not ammonia at all, but ammonia water or ammonium hydroxide. Although ammonia can be liquefied, it is a colorless gas at normal temperatures. The fact that it dissolves readily in water makes the manufacture of ammonia water possible.

You hardly would suppose that the fumes rising from an open bottle of house-

hold ammonia are inflammable. Yet, ammonia gas can be burned. To demonstrate this, place an ounce or two of household ammonia in a small flask. Fit the mouth of the flask with a cork containing a metal or glass outlet tube and beat the ammonia gas to flow from the outlet tube and a match held close to the tip will cause the gas to burn as long as the match flame is present. If the outlet tube is placed in an atmosphere of oxygen, the ammonia gas will not only flame but will burn steadily.

Like hydrogen, ammonia gas is lighter than air. For this reason it can be collected by holding an inverted bottle over the mouth of the generator flask. When the bottle has filled, it can be tipped upright by closing its mouth with a flat card or square of glass.

Collect a bottle of the gas and seal it with a card in this manner. If the bottle is then righted, the card removed, and a burning match dropped in the gas will flame and glow slightly as it burns.

Household ammonia often contains impurities such as soap and oleic acid that make it unfit for use in experiments requiring pure ammonium hydroxide. The amateur chemist can prepare pure ammonium hydroxide, however, by heating some household ammonia and allowing the

gas evolved to bubble through water. Make some, place it in a rubber-stoppered bottle, and label it "ammonium hydroxide." You'll find that it will be a useful addition to your stock of chemicals.

It has been found that as many as 200 volumes of ammonia gas can be dissolved in a single volume of water. This particular property forms the basis of an interesting fountain experiment similar to the one deser bed some months ago, except with sulphur compounds. (P.S.M., Sept. '32, p. 50.)

First select a large-mouthed bottle and fit it with a cork having a hole through its center. Push the glass portion of a straight medicine dropper through this hole so that the tip of the dropper is inside the bottle and connect a short length of rubber tubing to its outer end. Fill the tube and dropper with water and snap a pinch clamp over the middle of the tube.

FILL the bottle with ammonia gas by inverting it over a heated flask containing household ammonia and quickly insert the cork containing the dropper. By squeezing the rubber tube above the clamp you can cause some of the water in the tube to flow into the bottle and dissolve some of the gas. This will form a partial vacuum inside the bottle.

Holding the bottle inverted, immerse the lower end of the rubber tube in a beaker or glass of water and remove the pinch clamp. The vacuum in the bottle will suck the water up through the tube and dropper and create a miniature fountain.

You can make the effect more mystifying by placing several drops of phenolphthalein solution in the water before you open the pinch clamp. The water will remain colorless until it enters the bot le.



AMMONIUM HYDROXIDE

With the apparatus shown above, ammonia gas is evolved by heat and passes into the bottle of water at left where it dissolves to form ammonium hydroxide. At right, how the stand for flask is easily made.



As it mixes with the gas, however, it will turn red because of the alkaline effect of the ammonium hydroxide formed.

When heated with a caustic, such as lime water or lye water, all ammonium compounds decompose to form ammonia gas. For instance, if sal ammoniac is mixed with powdered lye and water, ammonia gas is evolved without the presence of heat. This, by the way, is a very simple and inexpensive way to prepare ammonia gas in the laboratory. Sal ammoniac can be purchased in any drug store and almost every home has a can of powdered lye on hand. The same type of reaction will take place if the sal ammoniac is mixed with lime water, excepting that in this case heat will be necessary to complete the process.

WITH certain types of ammonium salts and alkalies, you do not even have to add water to produce the ammonia gas. Sodium carbonate (soda ash) and ammonium chloride, both odorless substances, will react to form ammonia gas when they are rubbed in the palms of your hands.

Another simple way to make ammonia gas is to heat certain types of organic matter such as hair or pieces of animal horn. As a laboratory experiment, the amateur chemist can place some finger nail clippings in a test tube and heat them. A small piece of red litmus paper dampened and placed at the mouth of the tube will detect the alkaline trace of the ammonia gas evolved. This experiment can be made more effective by placing a small amount of dry lime or lye in the tube with the nail clippings. Incidentally, when handling lye it is best to use a glass or metal scoop.

Since ammonia and all its compounds contain nitrogen and hydrogen, the gas can be decomposed by the experimenter to obtain nitrogen. This is done by passing

Simple Experiments and Home-made Apparatus Extend Your Knowledge and Speed the Work You Can Accomplish in Your Own Laboratory



Having filled a bottle with ammonia gas by inverting it over a heated flask containing household ammonia, insert a cork containing hose and dropper which are full of water. Squeeze the tube to force water into the bottle. Then holding the bottle inverted, release the clamp. Water will be drawn through the tube and spout out a small stream in the bottle. Drawing below shows the construction of the basic pinch clamp.



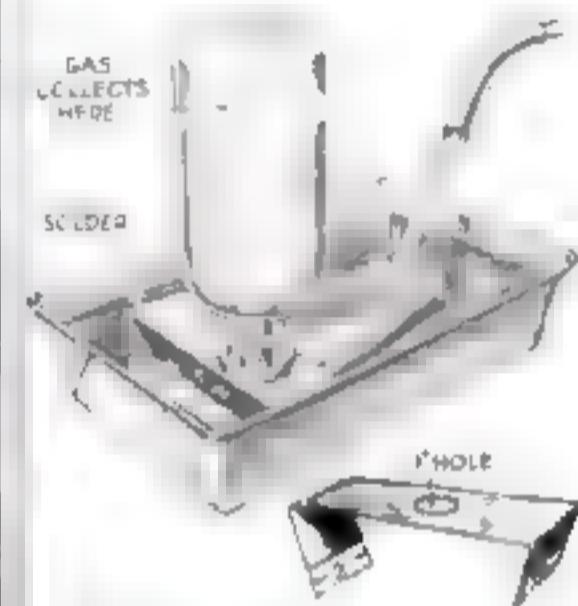
the gas over a hot metallic oxide. In the process, the hydrogen in the ammonia combines with the oxygen of the oxide, forming the metal and water, and the free nitrogen gas is released.

In the home laboratory the chemist can perform this experiment with a simple piece of apparatus assembled from various odds and ends.

SOME copper fly screening is first made into a small roll about eight inches long and placed in a short length of iron gas pipe. The outlet tube from an ammonia gas generator is led into one end of the pipe through a tight-fitting cork while a long outlet tube having a flexible rubber joint is fitted through a cork in the other end.

The entire apparatus should be arranged high enough to permit the iron pipe and the generator flask to be heated. The flask can be placed on an improvised

By
RAYMOND B.
WAILES



HOW TO MAKE PNEUMATIC TROUGH

Drawing shows how trough used in collecting nitrogen, on page 48, is made.

stand made from short lengths of ten-cent curtain rods. The rods should be bent at the proper points and threaded or glued into holes in a small wooden base. A square of copper fly screening placed over the uprights will support the flask.

With the ammonia generator disconnected, heat the iron pipe with a gas burner. This will cause the copper screening to become oxidized, forming a coating of copper oxide. Then connect the generator, apply heat, and immerse the end of the outlet tube leading from the other end of the iron pipe in the water-filled collecting trough.

THE trough can be made from a ten-cent baking tin by soldering a bridge-like strip of tin across one end at such a height that it will be below the level of the water. Fill an empty bottle with water and carefully place it inverted on the bridge directly over an inch hole cut in the metal.

When the generator flask is heated ammonia gas will be released and will flow over the heated copper oxide in the iron pipe. The hydrogen is removed from the ammonia by the hot oxide and the pure nitrogen gas bubbles from the outlet tube.

To collect the gas, place the outlet tube under the hole in the metal bridge supporting the bottle in the trough. The gas will bubble up into the bottle and displace the water. When the bottle is completely filled with the gas, carefully slip a piece of glass under the mouth and remove it from the trough.

By experi-

(Continued on page 94)

• Latest INVENTIONS

SEATS BED AND DIVAN. Those who've in small apartments will be interested in the three-in-one couch seen below. It is a davenport, opens to a bed, and seats four for bridge.



KILLS VIBRATIONS.



A MASTERS GAGE.



SUN LAMP FOR THE HOME. Any ordinary lamp is converted into a violet-ray sun lamp by merely connecting up the convenient adapter seen above. Installed without tools.

NUT CHOPPER. When the foil container is tilted and the handle turned, nuts or fruits are chopped.



SOAP IN A DISHWASHER. A chamber in the dishwasher holds soap so that dishes can be sprayed with soapy water. Then at a touch of a lever they may be rinsed off with clean water. It is easily attached to a faucet.



OPENER GLANDS DOOR. The bottle opener which can also be used to stop a keyhole and prevent the use of skeleton key as shown at left.

TOASTS YOUR MARSHMALLOW. Heated by electricity, the toaster shown below quickly barbecues marshmallows. It is provided with three forks.



Make Home Tasks Easy



KEEPS OUT UNWELCOME VISITORS. With the radio device, pictured below and at left, you can talk to a carer at the front door from any room and identify him by his voice without the necessity of opening the door. No earphones are used and the announcer is quickly turned on. Two-way conversation is possible.



NEW TOOTHPASTE HOLDER. When a tube of shaving cream or tooth paste is set in this holder it cannot tip over and the contents are easily taken out by twisting base.



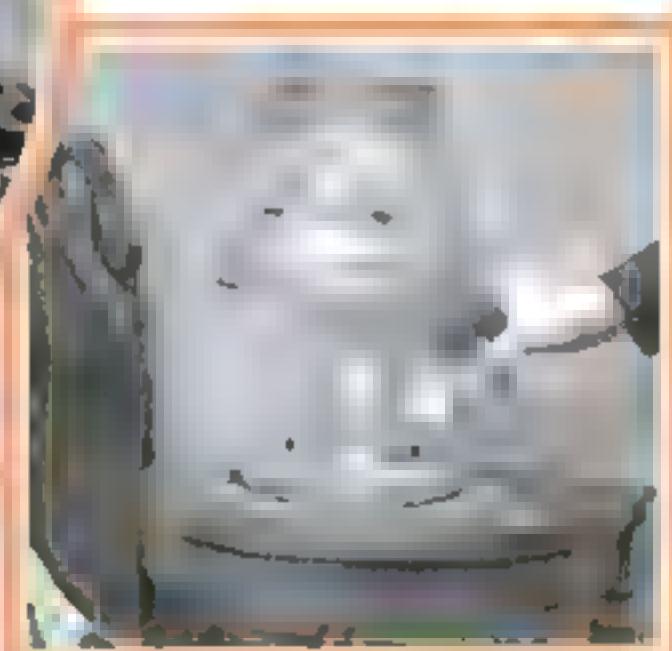
SPOON AND FORK HANDLES. Into these compact iron handles paper sleeves of forks are inserted for outdoor use. Handles may be used often.



KEEPS SOAP HANDY. This box, attached to wall, releases soap at a touch. Case goes back into open top.



SPRINKLER FILLS ITSELF. Immersing this sprinkler in a bowl of water fills it. Made of aluminum, it is non-breakable and may be used to sprinkle water or moth killer.



TWO LIGHTS IN ONE. Installed in the base of this bedside lamp is a night light with a moveable shade and operated by a switch separate from main light which is turned on as depicted.



SIPHON BULB. Fitting the stopper tight to a bottle containing any liquid converts it into a siphon. As the bulb is squeezed, the contents of the bottle are forced out. It is especially nice for use in making olive oil dressing.

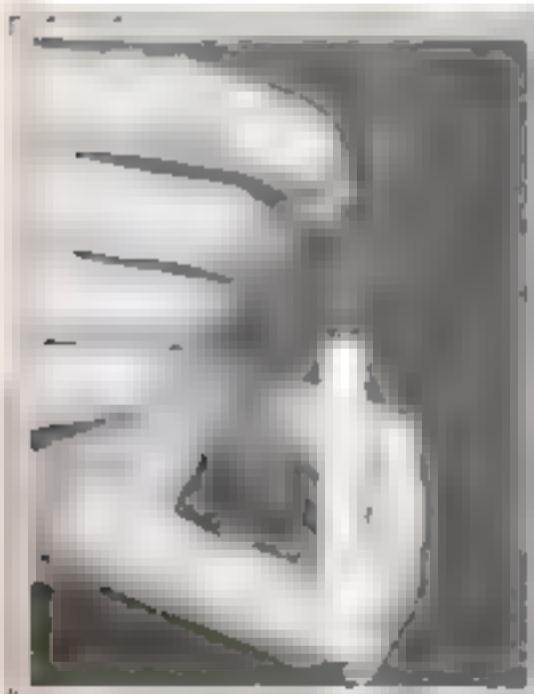
SAW BLADE ON SCISSORS. Cutting vegetables or meats is easy with the saw-toothed scissor teeth at left. The saw blade is not easily dulled. The scissors can also be used to remove the caps from all jars and bottles.



JOKES *to play on* Smokers

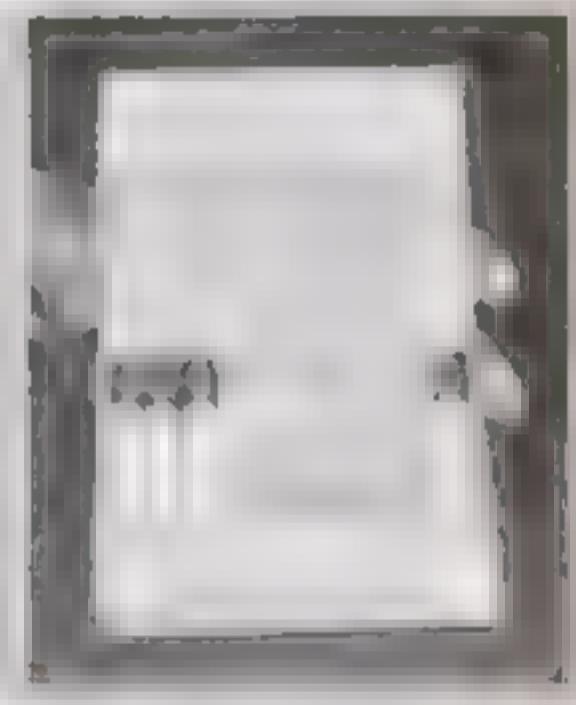


A TAKE ON SMOKE



THE CIGARETTE HOLDER

MATCHES THAT BURN



A

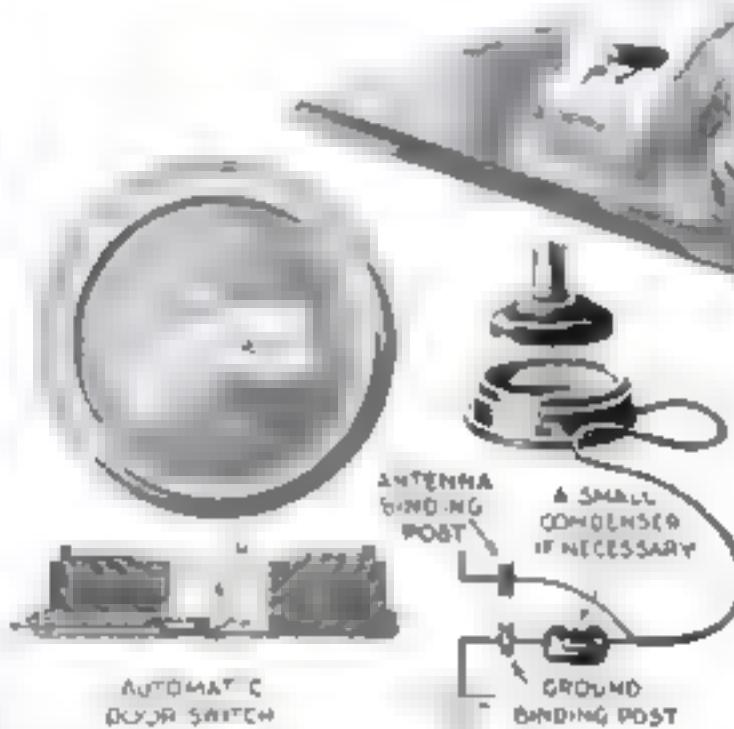


CRAZIEST

AUTOMATIC SWITCH

Quiets Radio When Phone Is Used

Lifting the phone from the stand, right, automatically dims the radio if the stand has a door switch set in its top and connected as shown in drawing below. At left, phone table is equipped with a push button that operates the dimming circuit.



MANY persons who find it virtually impossible to bear over a telephone while a radio receiver is operating in the same room resent the inconvenience of running to the radio to reduce its volume or shut it off entirely every time the phone rings.

With some wire, an ordinary doorbell button, and a small condenser, the handy man can rig a simple dimming switch with which the radio's volume can be controlled from the telephone table.

As shown in the diagrams, the push button and condenser are wired in series so that a short-circuiting connection across the antenna and ground terminals of the receiver is made when the button is pushed. The regular antenna and ground connection on the set are not altered.

With the push-button switch open, the radio operates at its full volume. Pushing the button reduces the volume to a suitable low level. Releasing the button, returns the volume to normal.

The correct value for the condenser in the circuit can best be found by experiment, since its size will depend on conditions. More and more volume will be obtained as the capacity of the condenser is decreased. In some cases, the circuit may operate better without a condenser.

In modern sets having automatic volume control, a dimming connection of this type may have no effect whatever on the volume. If this is the case, connect the push

button without the condenser across the voice coil of the loudspeaker to obtain the cut-out effect.

This same type of system can be used as the basis of a simple fully-automatic dimming switch. A low, wooden stand, turned or cut from a piece of square stock, is made to receive the base of the telephone. An automatic door switch of the type used to control a closet light is then recessed into the top surface of the stand and connected into the dimming circuit in place of the ordinary push button.

In use, the stand is placed at the back of the telephone table in such a position that the user will naturally lift the phone off to bring the mouthpiece within talking range. When the phone is on the stand the switch button is depressed and the dimming circuit is open. When the phone is lifted, the switch button springs up, the dimming circuit is closed, and the radio's volume is decreased. Re-



placing the phone automatically brings the volume back to normal. As with the push button, the circuit can be used to short-circuit the antenna and ground binding posts or the speaker voice coil depending on the circuit.—George Johnson

Banning Hums—Crackles

HUMS, crackles, and weird howls that develop suddenly in a radio set generally mean tube trouble. For instance, if a receiver emits a hum when the set is on, the detector tube may be at fault.

Hums, however, are not always caused by the receiver. Sometimes, the broadcasting transmitter is causing the trouble. For this reason it is always best to try the set on several stations before you waste time testing tubes and inspecting the wiring.

Your receiver may be working beautifully and suddenly develop a rapid-fire crackle or squeak. When a symptom of this kind develops, connect a resistance from the grid prong of the output tube to the negative B lead. If push-pull arrangement is used, a resistor should be connected to each tube. Start out by using a small resistance (about one megohm) and increase the value until the best results are obtained.



A resistance connected from the grid prong of output tube to negative B lead is used to check radio crackles.



RADIO receivers of the future will be housed in tiny boxes no larger than a jewel case. This prophecy was made by Thomas A. Edison late in 1920.

Today less than seven years later Edison's prediction is a reality. Miniature receivers, small enough to be held in your hand, are the latest in radio construction. Weighing as little as six pounds, these super-midget radios are masterpieces in compact design.

When you see one of these peewee receivers, you wonder how it is possible to cram so much equipment into so small a space. The answer is careful design and the use of a compact transformerless power unit to supply the current to the tubes.

By eliminating the need of a transformer, the receiver can not only be made lighter and smaller but universal since it can be operated on any type of current—direct or alternating. Strictly speaking, transformerless A.C.-D.C. power circuits are not new now when combined as they are with a compact receiver they allow genuine portability.

With a universal receiver you can plug the power cord into any 110 volt socket and get reception. The activities of the set are not limited to locations having either direct or alternating current. Even an outside antenna or ground are unnecessary in most cases. A twenty-foot length of flexible silk-covered wire serves as an antenna and, by the nature of the circuit, the set is always grounded through the power line. On some midget receivers, the antenna wire and the power cord when not in use can be stored in a small pocket at the rear of the cabinet.

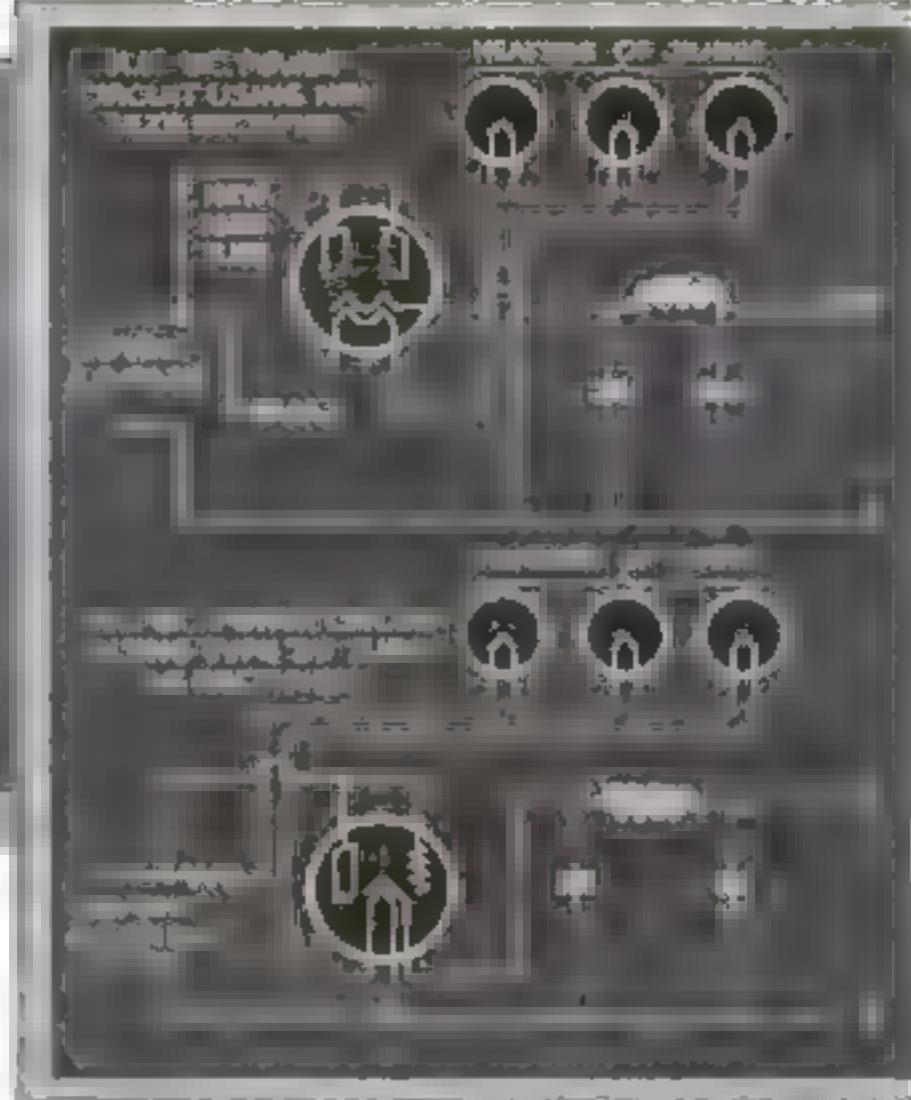
Of course, in a tiny set of this type, space is at a premium. It is impossible to design them to give service and reception equal to their larger brothers. But as auxiliary receivers for the home and portable sets for the traveler and vacationist they are ideal and give satisfactory service.

How the parts are crammed into the small cabinet is shown in the photograph of the chassis and the wiring diagram. On his particular midget, a high-grade dynamic speaker is used to give good reproduction in spite of the small diameter cone.

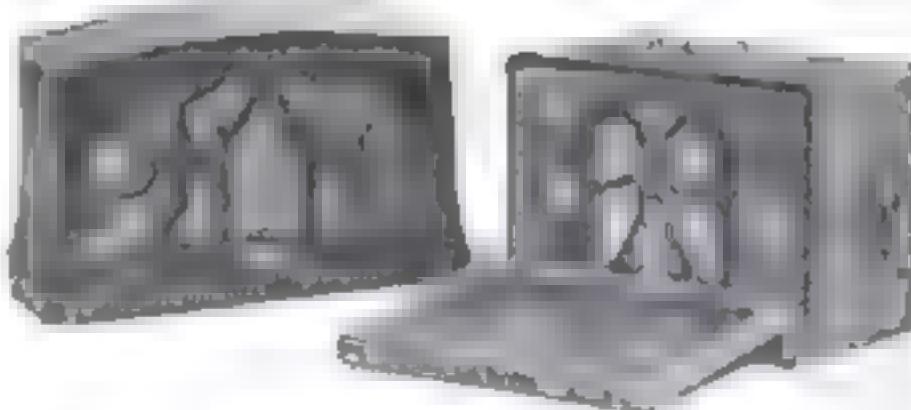
Although many of these miniature receivers are designed along tuned radio frequency lines, there are others, a bit larger and heavier yet still much smaller than the regular model models, that use a five-tube superheterodyne circuit that makes use of '77, '78, and '43 tubes.

The novel A.C.-D.C. power circuits used in these midget sets should be of particular interest to the radio fan, especially to those who build their own receivers. Although some universal circuits make use of the type '7 tube as a rectifier and others employ the new 25/3 rectifier tube there is a decided difference in the wiring and either is easily constructed.

When using the '37 tube as the rectifier, the plate and grid



These Novel Circuits Tom Thumb



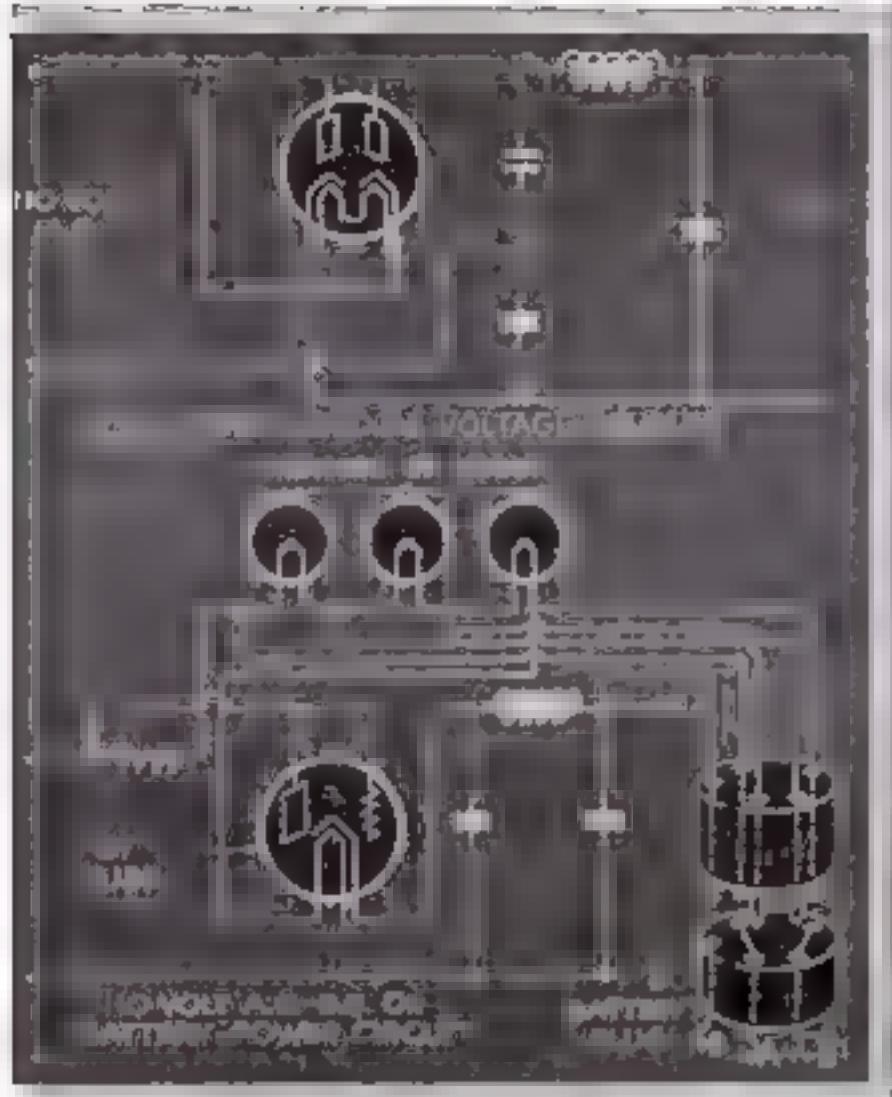
Here are two attractive cabinet designs, of which there are many to choose from, that house the universal midget sized receivers.

of the tube are used as a single element. This is accomplished by soldering a short length of wire across the grid and plate terminals on the tube socket.

Since the circuit operates without a transformer, the heaters of the tubes are connected in series and a suitable bias lasting resistor is inserted to cut down the full 110 volts supplied by the power line to a usable value. If, as in most cases, three six-volt automobile tubes ('36, '38, and '39) are used in addition to the rectifier, the resistor will have a value of approximately 300 ohms. The positive side of the filter circuit leads off from the cathode of the rectifier as shown.

When a circuit of this type is connected into an alternating current supply of 110 volts, either twenty-five or sixty cycle the heaters of the tubes receive their current direct while the B-current passes through the tube, is rectified, and filtered.

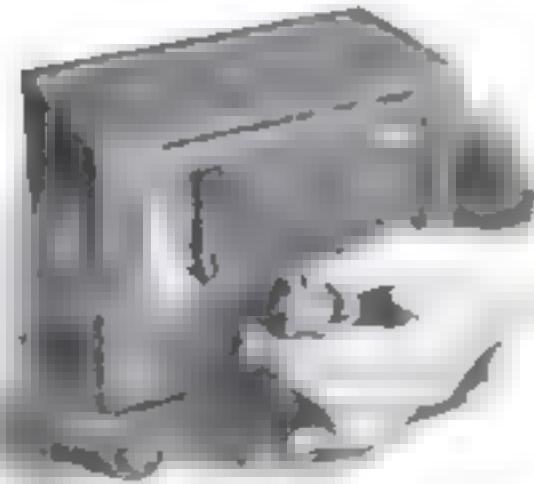
More or less the same thing takes place when the power



Are the Secrets of New Radio Sets

By
GEORGE H.
WALTZ, JR.

This pocket at the rear of this midget set of the universal design receives the twenty-watt antenna lead and also input cord.



supply is 110 volts direct current. Of course, there is no change when the direct current passes through the rectifier and filter other than a slight filtering action.

However, to operate on 110 volts direct current, any universal power circuit of this type must be connected correctly for polarity. The plate and grid of the rectifier must be connected into the positive side of the line. If the reverse connection is made, the tube heaters will light up as usual but no current will be passed to the plates, grids, and screen grids of the other tubes. Aside from failing to work, a wrong connection in no way harms the tubes or the circuit.

The circuit using the new type 2525 rectifier in place of the 37 differs only slightly from the one just described. The connections to the tube are, of course, different.

In reality, the 2525 rectifier is two independent half-wave tubes within a single bulb. It is provided with two plates, two



THE MAN IN THE PHONE BOOTH

and two series connected heaters, hot at 250 millivolts. The real advantage of the tube is that it can operate in transformerless A.C. circuits as a voltage doubler. Its double plates and cathodes make it possible to connect the tube in such a way that it will deliver approximately twice the regular output of a half-wave tube. The method of connecting the 2525 as a voltage doubler is given in the drawings.

However, the voltage doubling characteristic of the new tube is not the feature that makes it valuable as a rectifier for universal power circuits. Its high-voltage heater makes it particularly suitable on another score. By requiring twenty-five volts, it makes it possible to reduce the value of the ballasting resistor connected in series with the tube heaters.

In an A.C.-D.C. circuit the 2525 is used with its twin plates and cathodes connected in series as shown. The two plates function as the input electrode and the two cathodes feed the filter circuit. In reality it operates as an ordinary half-wave rectifier.

A receiver having a universal power circuit also can be wired so that it will operate on batteries. Arrangements of this type make the midget even more versatile since it then can be used in motor boats, automobiles, and summer cottages where 110 volts is not obtainable.

This added feature is obtained by the connections shown in the drawings. The wiring is so arranged that plugging in the batteries automatically changes the heaters of the tubes from series to parallel and makes the necessary B-current connections. In this case the rectifier is left out of the active circuit. The connection plug is used as a switch and besides disconnecting the filament current from the circuit it also excludes the B battery.

Through the use of an external ballasting resistor of the right value to cut down the voltage to 1.0, these circuits also can be used on a 220 volt A.C. line without altering the internal connections. The external resistor should be well wound.

As in any receiver whose circuit is grounded through the power line, the antenna lead enters the receiver circuit through a small capacity condenser (about .002 mfd.) This serves as a precaution against a possible short circuit.

Due to the internal ballasting resistor used in these circuits, sets of this type may tend to heat up when in operation for any length of time. Many manufacturers of midget sets warn users not to place the cabinet in a confined space or operate the receiver on a shelf over a radiator. Some midgets develop heat equivalent to that given off by a thirty watt electric lamp.

However, to avoid any difficulties from overheating, the ballasting resistor often is made a component part of the power cord which leads to the electric light plug. The resistance is carefully wound around the insulated wires and a silk and asbestos covering is formed over the entire unit.

"Looks fine," said Gus as he held the bottle to the light.
"But looks don't mean much."



Save Oil and Pay for Repairs

BY MARTIN BUNN

GUS WILSON was spending his holiday battling the weeds that threatened his garden. Paul Mathews, next door neighbor paused on the way to his garage and waved a greeting.

"I've got to get the oil changed in my car," he announced. "I think I'll try a place out on the Pike where they sell it for half the regular price."

"What oil is it?" Gus inquired, seeking at a particularly stubborn weed.

"Search me. Some new brand. I think and it looks good. I know a fellow who's been using it for several months and he swears by it."

"It's possible," the grizzled auto mechanic agreed with a smile. "It takes a while for the effects of bad oil to show. If you can wait till I change my clothes, I'll run out with you and take a look at this bargain stuff."

An hour later the two men pulled up at a small roadside gas station. A grease-smeared individual shuffled toward the car in which they sat.

"I want the oil changed and I thought I'd try some of that special low-priced stuff," Mathews told him.

"Sorry boss, but we don't change oil," said the man. "Can't afford to at the price. You can buy it here and change it yourself."

"What kind of oil is it?" asked Gus.

"Special brand, master. Got an agreement with the producers so's I can sell it cheap. Good oil too," he said, lifting a bottle from a low stand beside a gas pump. "Look at that color."

"Looks fine," grinned Gus, taking the bottle and holding it to the light, "only looks don't mean much with oil."

"Who says so?" demanded the man.

"Any time you see oil flow like this, you can bet it's good. It's got good body see? Stick your finger in and feel of it," he invited, unscrewing the cap. "I've got it in all the regular grades, too, from the lightest to the heaviest."

"You can feel an oil if you wear out your fingers," insisted Gus, "and not find out a thing about its quality. The expert isn't born yet who can tell the quality of an oil by looks or feel."

"Say, are you telling me?" the man growled. "I've been selling oil for years and I guess I know what I'm talking about."

"I can see that," Gus replied good-naturedly. "Well, we've got to make another stop. We'll pick up the oil on our way back."

Somewhat bewildered, Mathews stepped on the starter. "What's the idea?" he demanded as the car gained speed. "We haven't any other stops to make."

"Yes, we have," corrected Gus. "I've got to stop off at the Model Garage and

you're coming, too, and learn something."

"Listen, Paul," said Gus seriously, "that oil's no good. If it was, don't you suppose all the other gas stations would be selling it?"

"How do you know it isn't any good?"

Mr. Mathews snorted. "You said you-

wanted to tell anything about an oil

by looking at it."

No, but you can tell a lot by looking at the guy who sells it. You can't get good oil at that price. It takes a high-grade oil to stand the gaff if a car or

cheap muck will do the trick."

But he's got it in all the different

grades of thickness just like any other oil," Mathews argued.

True, but that doesn't mean anything either. The thickness or viscosity of an oil is only an indication of its body at a certain temperature. The thickness of motor oils is graded by numbers—from ten for the lightest to seventy for the heaviest. But those ratings have nothing to do with quality. The numbers are just like shirt sizes. All they tell you is whether you have a fit. Quality is something else again."

"Well, I don't see why they can't produce an oil that will last longer," said Mathews. "Changing it so often—"

Is a damned nuisance, I admit," Gus finished for him. "But that's a job I'm afraid you can't dodge. No matter how perfect the oil, it's bound to be thinned after a while by the unburned gasoline, water vapor, and road dust in a motor. And you can't lubricate a high-grade piece of machinery with that sort of muck. Some of the oil just disappears too. Right now, for example, you're driving this" (Continued on page 93)

GUS says:

Next time you have an urge to jam your accelerator to the floor, remember that jumping a car's speed from forty to sixty just about doubles your driving costs. Besides, a car doing sixty miles an hour has about the same destructive force as a two-ton weight dropped from the top of a building 125 feet high.

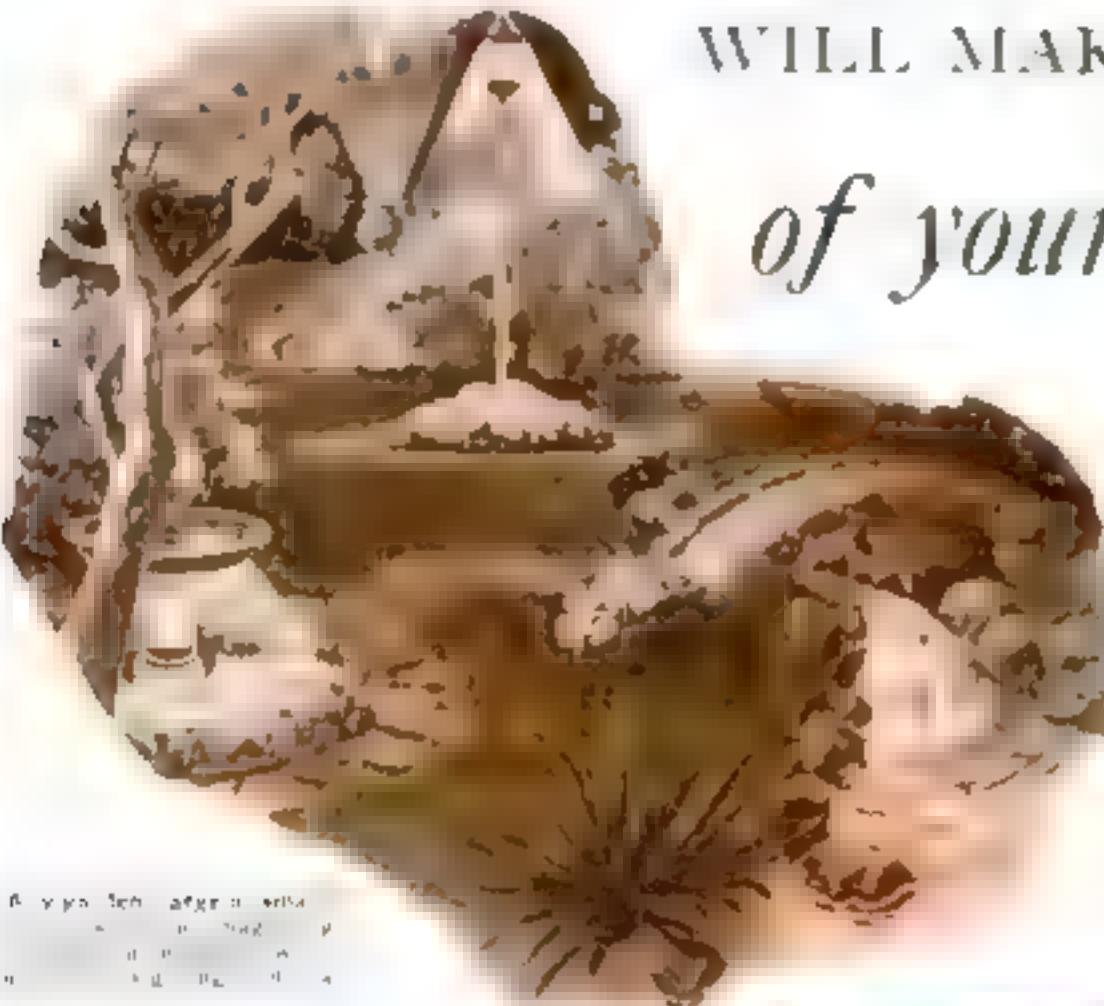


MODEL MAKING & HOME WORKSHOP CHEMISTRY: THE SHIPSHAPE HOME

Simple Lighting Stunts

WILL MAKE A FAIRYLAND

of your Garden



B3

WALTER E. BURTON



Birds have been seen and over three thousand birds at night. Green woodpecker

between bulb and socket can also be purchased.

For special effects, color screens can be placed in front of the reflector. Colored cellophane, glass, or special materials designed for show-window use are suitable if properly protected from the weather. The cellophane can be held in a wire or sheet metal ring attached to the aluminum bowl by screws.

You may desire a very high intensity of light over your garden during parties or for other relatively short periods. One of the cheapest ways to obtain this is to use photoflood lamps. These lamps, costing 35 cents each, consume about 300 watts, produce illumination equal to a 750-watt standard lamp, and when burned at 115 volts will last two hours.

Ordinarily it is more desirable to use a number of smaller, well-placed units rather than one or two large flood lights. Small 10-cent aluminum mixing bowls and lamps of from 15 to 30 watts can be used to make lighting units that will cast a soft, pleasing glow over a tree, shrub, flower bed, or piece of garden furniture. Such reflectors may be equipped with sharp spikes so they can be placed anywhere on the ground, and they can be moved about and directed as desired.

Reflector made from a small aluminum mixing bowl and a screw-ring socket. Such a unit may be waterproofed by using melted sealing wax.



The outfit for making this small flood-light reflector was less than 40 cents. The unit is set up wherever desired in the garden simply by pushing the pointed end of the support into the ground.



A little more elaborate set-up consists of a cut-out bird with its wing mounted less than $\frac{1}{2}$ in. in front of its body, as illustrated at the bottom of page 59. The rear surface of the wing is painted white, and the lamp placed so that light coming through a hole will be reflected from the wing over the remainder of the body. Sheet aluminum can be used for the cut-outs and the front surfaces made "satiny" with a strong lye solution.

A novel way of calling attention to particular flower groupings is to use a translucent screen, such as a sheet of draftsman's tracing cloth held in a frame of pleasing shape. Place the screen in front of a plant and mount a suitably colored lamp behind it so that the shadow images of the flowers are thrown on the screen to make an attractive living picture. If two light sources of different colors are used, the shadows will be in various and striking hues.

If it is lighted properly, the bird bath continues to hold the center of the garden stage at night as well as in the daytime. Birds will not be bathing at night and the bath may therefore be treated entirely as an ornament or lighting fixture. A few concealed lamps placed about the lower surface of the bowl will illuminate surrounding flowers. An ordinary bath can be brought into prominence by means of one or two flood-light units directed toward it.

An ingenious method of employing the bird bath to fullest advantage at night is to make it a housing for several reflectors which cast their beams on nearby parts of the garden. A particularly effective arrangement of this kind is shown in the illustrations at the bottom of page 57.

To make an illuminated bird bath of this type, construct a hollow pedestal, a square form being simplest. Make a framework of metal or wood, and panel three sides with some translucent material such as frosted opal glass. Cover the fourth side with clear glass having a



In illuminating trees it has been found that a single source of light often produces a harsh effect. This can be eliminated by using two reflectors placed so that one furnishes a general illumination while the other breaks up the monotony by providing high-lights. The best color of light for a tree, where the green foliage is to be shown in its natural hue, is a special light green or bluish-green. Other colors can be used for producing special effects, for the leaves reflect several hues other than green.

Against a background of general illumination provided by small reflector units, you can accentuate points of special interest by means of small bulbs and suit-

able shields. Thus, a choice group or border of tulips can be brought into prominence by placing a 5-, 6-, or 10-watt lamp close to them and keeping its direct rays from the eyes of the observers by means of simple metal shields mounted on pointed wood or metal standards, as shown in two of the illustrations on this page.

These shields, which you can make without difficulty, may be in the form of flowers, birds, or other decorative objects. They are, of course, gaily painted on the front side and provided with a reflecting surface on the reverse side painted white or aluminum.



Corner of an informal garden with trees and flower beds illuminated by the equipment shown at the right. The lighting is a soft, dappled effect.

pebbled texture that will diffuse the light evenly. Inside the pedestal, place two or three small flood-lighting units with ring-bowl reflectors. Also, include two or three colored lamps for lighting the glass. Mount a conventional basin on top.

Still another birdbath stunt is to mount a small crystal ball or statue above the basin, and place a lamp or two below it under the pan if necessary, allowing the illumination to come through a specially constructed water-tight aperture from beneath.

Sleek reflecting balls are popular garden ornaments. They become doubly attractive when two small spotlights or flood lights, casting different colored beams, are directed toward them.

Speaking of spotlights, you can rig up an inexpensive fixture for throwing a concentrated beam of light by mounting a socket inside a length of stovepipe and fastening a plano-convex lens over one end. Use a clear glass bulb for maximum concentration. Instead of this, you can employ cheap automobile spotlights operated by a toy transformer.

The garden pool can be lighted in an endless number of ways. A simple flood light, throwing its beams on the rippled surface of the water often is enough, particularly if the beam is colored. Another method is to submerge and preferably conceal one or more bulbs beneath the surface, where their glow will be diffused throughout the pool. You can do this by screwing the lamps into waterproof sockets and sealing them with wax, as already described.

If you are building a



Opaque shield for localizing the light on a special plant or bed of flowers.

den trellises, chairs, and other furniture, bird houses having small lamps beneath the eaves or under the bottom for illuminating surrounding flower beds brightly painted metal flowers that can be placed in the center of flower beds, with lamps concealed beneath the metal petals; and troughs, in two sections, that can be mounted about tree trunks for illuminating the foliage above.

The list could be prolonged indefinitely. The possible effects are limited only by the garden owner's ingenuity or resources. The beginner in garden lighting will look in vain to electrical supply dealers for convenient kits. Therefore, lighting experts at Nela Park, Cleveland, Ohio, have suggested a list of equipment which will be found convenient for the average sized garden. It includes the following:



Metal base for lighting a garden of moderate size. Their value is from \$15 to \$40. The outfit includes four small flood-light projectors, one larger projector, and seven sockets for holding intermediate base lamps.



pool, you will be wise to provide for underwater lighting by the inclusion of one or two glass windows in the wall behind which lamps can be placed. The same is true of miniature waterfalls or fountains. The light should be placed where experiment shows it will give the best effect. By using several colors of light you can produce an unlimited variety of effects in pools, waterfalls, and fountains.

Among other pieces of lighting equipment you can make or purchase for use in your garden are portable work lights having pointed standards which can be stuck anywhere; portable, ornamental lanterns on standards; Christmas tree miniature lamps, which can be used for producing individual spots of light or can be inserted into the necks of inflated rubber balloons for forming striking garden party lanterns; lamps concealed beneath the caps of stone or concrete walls, under copings of stone balustrades, in gar-

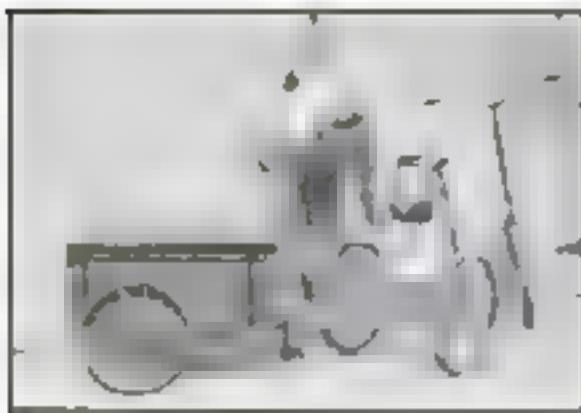
A weatherproof string of seven multiple sockets for intermediate base lamps, 6- or 10-watt lamps to fit the sockets half a dozen opaque metal shields with lamp-socket clips at the rear; a metal bird with wing set forward; four small flood-light projectors and one larger projector; four bulbs of 40-watt size, one 100- or 150-watt lamp for the large reflector, and waterproof flexible cable.

TINFOIL REPAIRS WORN INSTRUMENT THREADS

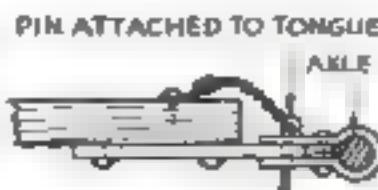
When the threads of any small tool or precision instrument have become worn or partly stripped, it is an easy matter to make a reasonably permanent and accurate repair by pressing into the threads on the inside of the nut a small strip of tinfoil. After the foil has been pressed as deeply as possible into the crevices of the threads, it should be gently removed, care being taken not to spoil its shape, and given a coating of strong shellac or glue. It should then be replaced with equal care until the shellac or glue is thoroughly dry.

In instruments or apparatus of large diameter, such as the object lens of a pair of field glasses, four shorter strips may be placed at equal distances around the inside.—FORREST L. HIRANSON

TOY TRAILER FOR USE WITH TRICYCLE



Hooking up the trailer left and a drawing of the coupled joint right.



photograph the businesslike look given by the heavy tongue and by the wings above the wagon box. The tongue has a strap iron up with a hole in it and this part fits into a U-shaped attachment that is bent around the rear axle of the tricycle and riveted. This arrangement is made clear in the drawing above. An iron pin is slipped through the holes in the U-shaped piece and the tongue when it is desired to attach the trailer to the tricycle. The pin is chained to the tongue so that there will be no danger of its becoming lost.—D. A. BUTLER.

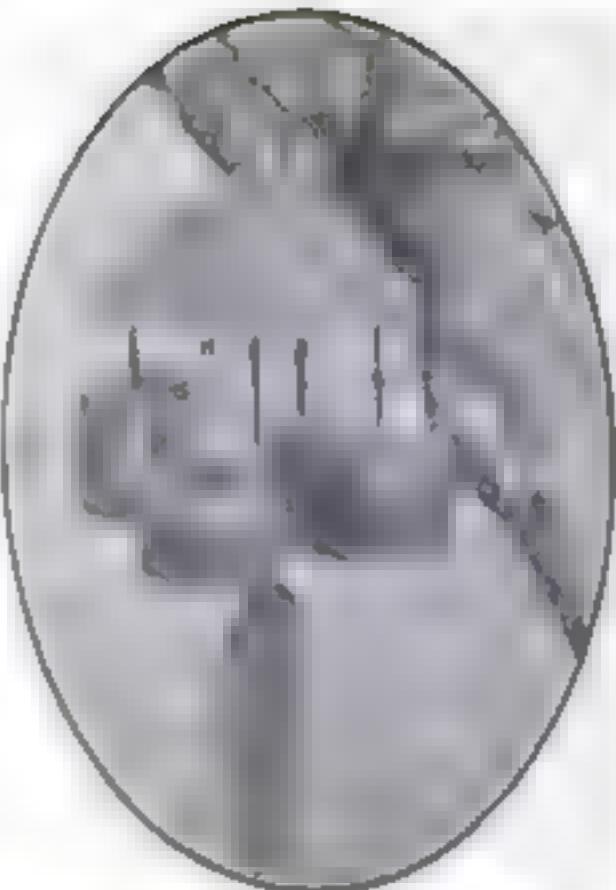
PUNCHING BAG PLATFORM MADE FROM OLD TIRE

While hunting for something with which to make a punching bag platform, I came across an old automobile tire casing. I stuffed this tightly with old rags, taped it to hold them in and mounted it on a wooden framework, which was attached to the basement ceiling and braced to prevent vibration, as shown in the accompanying illustration. That part of the framework immediately above the tire is shaped like a cross, and the punching bag cord is suspended from its center.

It would have been still better if an inflated tire or a disk wheel with the tire in place could have been used. Such a platform is heavier and quieter than one constructed of wood, and it costs practically nothing.—P. G. BRENNER



A punching bag mounted like this is much quieter than if an old wooden platform is used.



OLD AUTO PARTS FORM UNIQUE WIND BELL

This melodious wind bell shown in the photograph above was constructed from parts of wrecked automobiles. It makes an attractive ornament for the garden, summer house, or porch, and its round, bell-like tone—like the chime of distant temple bells—is appealingly soft, mellow, and rich.

The hammered and fluted canopy originally saw service as the reflector of a head lamp. Three of the "bells" are old brass carburetor bowls, the fourth and tallest one served as the inner compartment of a vacuum tank.

The clapper is a turned hardwood knob that formerly did duty as a drawer pull. It is of such size as nearly to fill the space between the gongs. The wind vane in the bottom of the central cord is an odd scrap of thin sheet brass trimmed to shape and given a hammered effect. A little oil color applied with a spray gun gave the completed wind bell an antique appearance.—R. GRALD BELLARD



SLING FOR MOTORBOAT

OUTBOARD motor enthusiasts who seek some method of bringing their boats out of the water to be stored temporarily under docks without damage to the thin hulls will find firemen's canvas hose the answer to their problems. Rigged up as shown in the photograph above, the boat will be safe from damage. Old hose can usually be obtained at your local fire station at low cost.—HARRY MAUKE, JR.

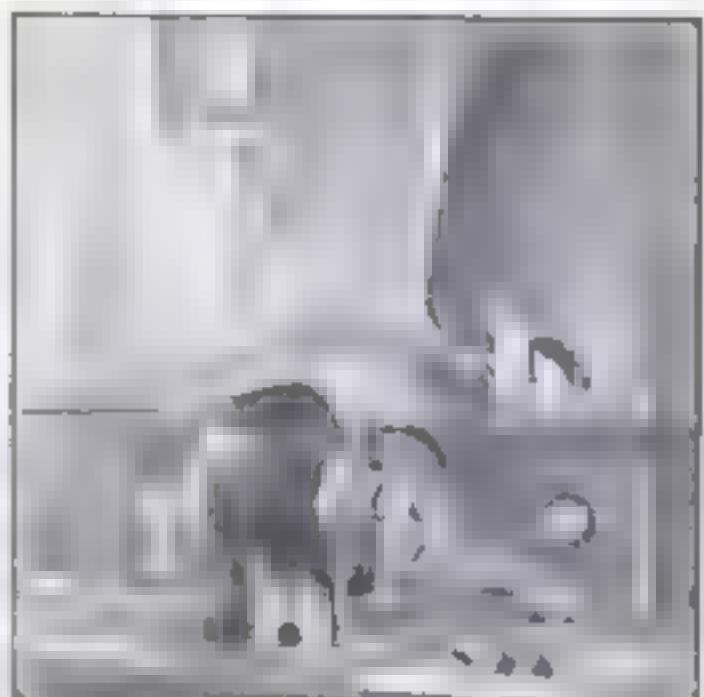
RULING PEN AIDS MODEL WORK

MODELS, especially very small ones like the liner *Manhattan* (P. S. M., Feb. '33, p. 63) can be painted more easily if the fine lines are made with a draftsman's ruling pen.—CHARLES E. O'MALLEY

COLLECTING DUST FROM BENCH GRINDER

AN OLD VACUUM CLEANER can be easily converted into a dust collector for a bench grinder. The cleaner may be placed under the bench, on the wall, or in any convenient location. The hose is then brought in behind the grinding wheel, and one of the fittings usually supplied with vacuum cleaners is fastened a little below the wheel. If no such fitting is available, one can be made from a small piece of sheet metal. With this arrangement, all the dust from the grinding wheel is instantly removed.

The grinder illustrated is used for grinding electric motor brushes. These are made of soft carbon and give off a large cloud of dust which, if inhaled by the operator, would be certain to cause violent sneezing. H. F. LOWING.



An old vacuum cleaner arranged to collect dust behind a bench grinder used for electric motor brushes.

Jig-Saw Short Cuts

How to make high-grade puzzles—Methods I learned in building up a paying business

BY W. L. FAUROT

Author of *The Art of Whittling*

EVERY operation in making a really fine jig-saw puzzle requires extreme care and cleanliness. No matter how quickly the vogue for cheap cardboard puzzles may pass, there will always be some demand for high-grade interlocking wooden puzzles; and from the standpoint of the home worker, picture puzzles are among the most desirable and inexpensive gifts.

Preparing the Panel Use 3/16-in. basswood plywood. (Panels sold as 1/8 in. thick by some manufacturers are almost as thick as the 3/16-in. panels of other manufacturers and are quite satisfactory.) Allow 1/8 in. or more in wood dimension for expansion of print and trim. White casein glue commonly designated as No. 2, is admirable. Mix thick and spread evenly and thin with a stiff-bristled brush to the wood surface only. Let dry until tacky and apply the print. Press and smooth with a clean cloth, rubbing

from center to edges or cover with paper and roll with a print roller. There should be no air pockets. Be sure the edges and corners are firmly bonded. Dry under pressure. This method eliminates much of the warping sometimes caused by other commonly used systems of gluing.

If paste is to be used, the pan-



Faurot's tips for games in wood—an idea to remember when making up puzzles for 1/8 or 1/4 inch or as Christmas or birthday cards

els should first be sized with thin hide glue. Soak flake glue in cold water until dissolved, then bring to a boil, skim, and allow to cool. Cover the entire top surface of the panels. For the paste itself, add dry powdered paper hanger's paste to the thin, liquid glue and stir thoroughly to a creamy consistency. Spread the paste thinly on the back of the print first. This will allow the paper to expand slightly while the wood surface is being pasted eliminating stretch and consequent wrinkling which occurs when a dry print is placed upon a paste covered panel. In the simpler and preferred casein process, the glue is sticky and contains very little moisture to expand the paper. Paste and glue should be mixed fresh each

Roll the print until bubbles and wrinkles have been smoothed. Be careful not to get any glue on the picture surface, and clean the panel.

Lay the panel face down on a smooth, flat surface, and weight it evenly. If more than one panel is mounted at one time, stick them

placing paper between each pair. Should a bit of paste remain on any picture face, it will adhere to this paper instead of the back of the next panel and may be soaked off without harm to the print. Glue, however, is not so easy to remove and every precaution should be taken to keep it off the print.

When thoroughly dry, trim the edges with the

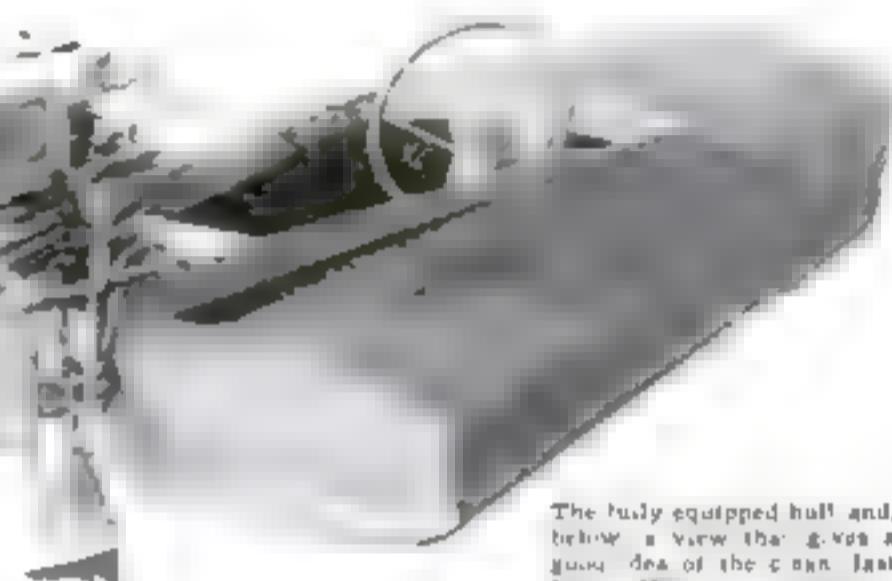
Continued on page 85



Planking and Finishing



Designed especially for class "A" and "B" motors, this speedy hull will give a good account of itself in any contest



THOSE readers who are building the new Port Lat SCIENCE MONTHLY outboard racer *Scream* and have constructed the framework as described last month (P. S. M. May '33, p. 59) are now ready to apply the planking.

The side planking material is clamped in place, marked to shape, removed, and sawn out before fastening the planks, coat the chines transom, and step with aviation glue. The shaped planks are clamped in place and fastened with 1-in. No. 8 screws spaced about 2 in. apart. All screws are flat-head unless otherwise mentioned. Use a double row of screws at the transom. Copper clout nails $\frac{1}{4}$ in. long are used to secure the planks to the inwale. After planing the plank edges smooth, proceed to notch in the battens for the bottom planking.

The batten notches are cut into the after step section first. As the bottom planking will be about $7\frac{1}{4}$ in. wide, cut out one of the after step planks the correct width and, using it as a template, lay the edge of the plank on the center of the keel. Mark the frames along the outside edge. Move the plank over and repeat the process for the rest of the battens. The $\frac{1}{4}$ by $1\frac{1}{2}$ in. batten material is carefully notched flush into the frames so that half of the batten is on each side of the plank mark just made. The plank edges will then meet in the center of the batten.

The battens are not bed into the forward plane in like manner with the batters in correctly as the smoothness of the finished hull depends upon the accuracy with which this job is done. Screw the battens to the frames with one 1-in. No. 8 screw to each joint. The after ends of the forward battens are notched half-way into the step as shown in one of the sketches published last month.

The planking is applied next to the after step section. Plank from the keel out to the chine, alternating with a plank

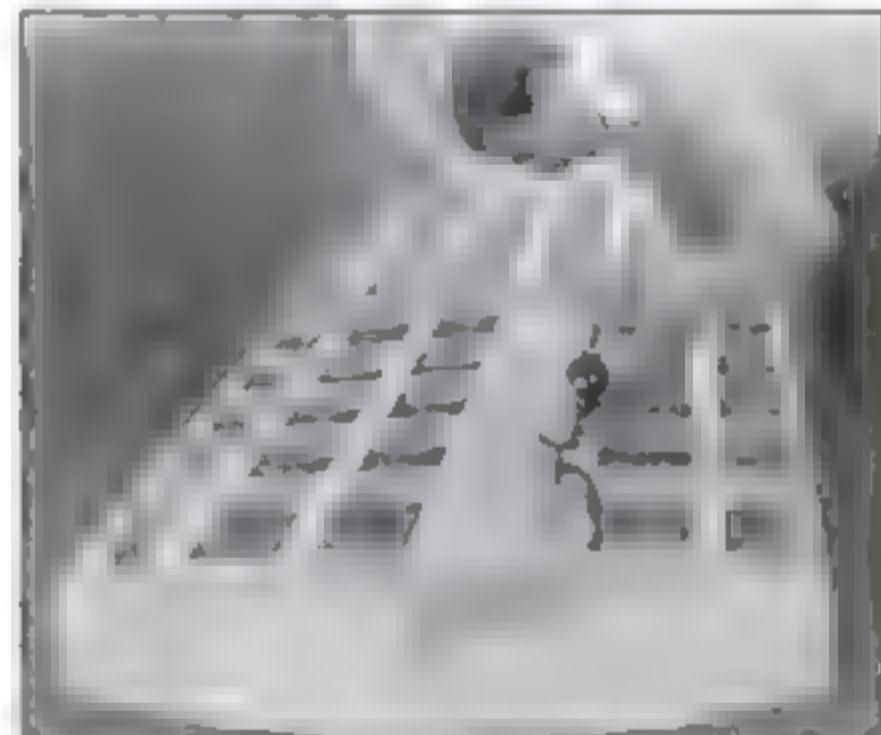
The *Scream* gets under way. Its length is 10 ft 7 in., overall beam 4 ft, weight with all essential fittings 134 lb.

The fully equipped hull and, below, a view that gives a good idea of the construction of the bottom planking at the stern. The oar and a right projection at the stern

on one side of the keel, then one on the other side. Before fastening the planking and as the work progresses, coat the keel, battens, chines, transom, plank edges, and step liberally with aviation glue and lay strips of muslin on the glued surface. A light coat of glue is then applied to the cloth. When the planking is fastened in place, the glue squeezes through and makes a thoroughly water-tight joint. Remove excess glue with gasoline or turpentine.

Fasten the planks to the keel, chines step, and transom with 1-in. No. 6 screws spaced about 2 in. apart. Nail the planks to the battens with $\frac{3}{4}$ -in. copper clout nails. A lead hole is first drilled and the nail inserted, then, while holding an iron on the underside of the batten, drive the nail home and clinch it.

The two forward planks next to the keel will require some fitting. Clamp one 8-in. plank in place. The after and forward edges of the plank at the step and stern will meet in the center of the keel

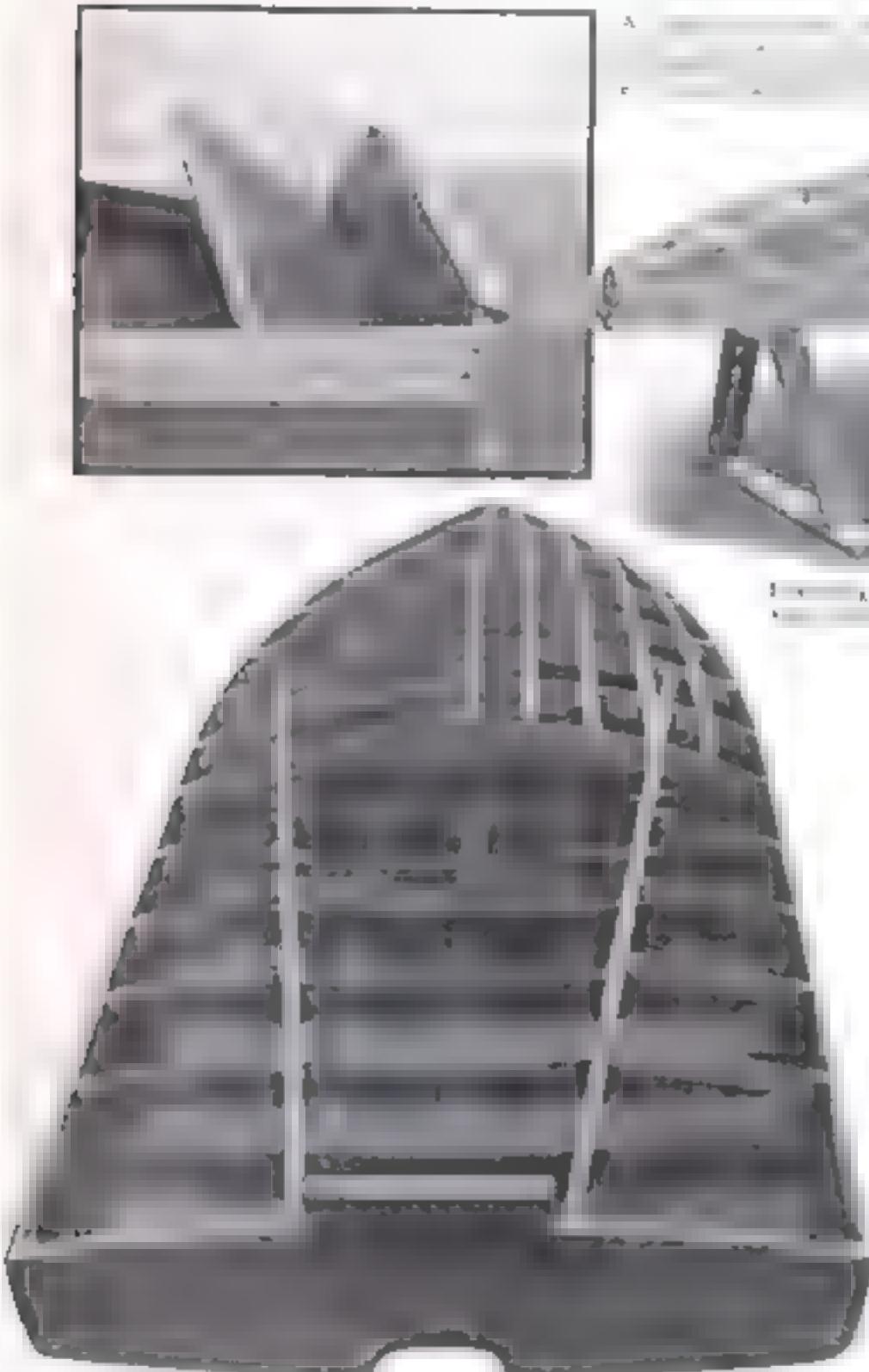


The bottom with battens notched in place ready for planking. Aviation glue and strips of cloth help keep the joints tight.

while toward the middle the plank will overlap the center of the keel. Draw a line across at every frame and mark frames along outside edge of plank. Remove plank and measure each frame from keel center line to the outside mark. Transfer measurements to the plank, spring a light batten around the marks to connect them up, and mark and saw to shape. The planking at the step projects $1\frac{1}{2}$ in. and at the transom $3\frac{1}{4}$ in., as shown in the drawings last month. When the hull is

our new Outboard Racer

BY WILLIAM JACKSON



A top view showing the cockpit railing, deck battens, and cockpit beams.

planked, remove it from the form and sand the bottom.

The transom knee is sawn to shape and attached to the transom with three $2\frac{1}{2}$ -in. No. 8 screws. The knee is secured to the keel with three $1\frac{1}{4}$ -in. screws, driven through from the keel. Fill all screw holes with a plastic wood composition or similar compound, then use coarse sandpaper and finish with fine sandpaper rubbing with the grain.

The deck beams are sawn out and fastened to their respective side-frame members with one $1\frac{1}{4}$ -in. No. 8 screw to each joint. Drill end holes for screws and afterwards saw off the projecting ends.

The cockpit railing is now fitted and fastened to the transom. Allow $\frac{1}{4}$ in. separation between the edge of the motor

and the railing. Fit the coaming to the hull and the transom. Fasten the coaming to the transom with four $1\frac{1}{4}$ -in. No. 8 screws. The coaming is fastened to the transom with two $1\frac{1}{4}$ -in. No. 8 screws. The deck battens are now fastened. These are curved toward the bow so that the completed deck presents a gracefully rounded contour. The plans published last month indicate the correct location of the battens. Only beam No. 7 is notched for the battens. The deck battens rest upon the remaining beams and are fastened to each with one 1-in. No. 6 screw. The ends of the battens are butted flush against the inwale and secured with one 1-in. No. 6 screw driven through from the outside. The forward end of the center deck batten is notched flush into the stem and fastened with two 1-in. No. 6 screws. Three coats of varnish are now applied to the inside.

The edges of the planking along the inwale are planed evenly, and the muslin decking is applied. This is stretched

tightly over the battens and tacked along outside edge of planking at sheet

I-beam No. 7 with $\frac{1}{4}$ -in. tacks. When the cloth has been stretched, since this is not too tight, four coats of varnishing dope are applied. The surface is sanded dry between coats and a half hour interval allowed for drying.

The $\frac{1}{2}$ -in. plywood cockpit decking is cut to shape and attached to the cockpit beam, transom, and sheet I-beam No. 6 screws spaced about 4 in. apart. The end of the cockpit decking may be cut square with beam No. 7 or squared off as shown on page 62. If $\frac{1}{2}$ -in. plywood is unavailable, $\frac{3}{4}$ -in. planking may be applied in two pieces. The ends of edges are secured by nailing $\frac{1}{4}$ -in. batten into the cockpit beam and nailing the edge of the cockpit decking to the battens with $\frac{1}{4}$ -in. copper brad nails.

The side of the transom and motor guard above the railing is beveled to allow the railing casting to fit evenly. The forward end of the coaming is tried against beam No. 7 so that $\frac{1}{4}$ in. projects above the beam. The after end is fitted so that, above the cockpit decking, it fits even with the outer edge of the transom, and below the decking it should fit even with the inner side of the transom. Fasten the coaming to the transom and railing with 1-in. No. 8 screws.

The cockpit end piece that covers beam No. 7 is sawn to shape and fastened with four 1-in. No. 6 screws. The end piece projects $\frac{3}{4}$ in. above the deck. The projecting ends of the bottom planking at the transom and stem are sawn to shape as indicated on the plans (May issue, p. 60). The projection at the transom is reinforced with a $\frac{3}{4}$ -in. filler piece. This is fitted, glued, and securely fastened to the plank projections with $\frac{1}{4}$ -in. copper clout nails. A circular well opening is cut out for the motor as the drawings show.

The combined (Continued on page 82)

Model of Old-Time Fireplace Forms Novel Cigarette Container

RARELY will you find a cigarette container as novel and picturesque in design as the one illustrated, which is an exact model of a New England fireplace.

The base is $\frac{1}{2}$ in. thick white pine, $5\frac{3}{4}$ by 10 in. The mantel is made of $\frac{3}{4}$ in. wide strips of cigar box wood glued to a piece of fiber wall board 6 in. high and 10 in. long. The fireplace opening, which is $3\frac{1}{2}$ by $3\frac{3}{4}$ in., is made $1\frac{1}{2}$ in. from the extreme right-hand edge of the wall board. The back, top, and sides of the fireplace opening are formed of wall board or cigar box wood, as preferred.

The dutch oven is an opening large enough to hold a box of safety matches. This is placed $1\frac{1}{2}$ in. from the left-hand edge of the wall board and $3\frac{1}{4}$ in. from the bottom, and is boxed in behind like the fireplace. A door is made for this opening out of sheet copper which is hammered to a convex shape and coated with black paint to resemble iron. It swings on hinges made from small brads bent at right angles and driven into the wall board. Below the match oven there is a smaller false door glued to the wall board.

Above the fireplace opening a piece of cigar box wood, by 4 in., is glued and colored to imitate an old charcoal holder. The mantelshelf is a piece of cigar box wood $\frac{3}{4}$ in. wide and $10\frac{1}{2}$ in. long fastened with small brads to the top of the wall board. Below this is a reproduction of an old flintlock gun carved from wood, and on the mantelshelf is a tiny reproduction of a pewter plate, made of tin.

The fireplace is fastened to the pine base 2 in. from the front edge so as to leave a hearth. The brackets are cut out of sheet copper and fastened in the fireplace opening to hold the cigarettes.

The hearth is painted to represent different colored stones, and the front of the fireplace is treated to look like old brick and stone.—H. L. STAPLES

WIRE BRUSH REMOVES CHIPS FROM CHUCK

For cleaning chips from the threads of a chuck back, the quickest and best method with which the writer is familiar is to use a wire brush as shown. The wooden back of the brush can be cut down or built up as required to fit the threaded hole properly. If this is done, it requires only a few sweeps back and forth to remove the most tightly stuck chips.

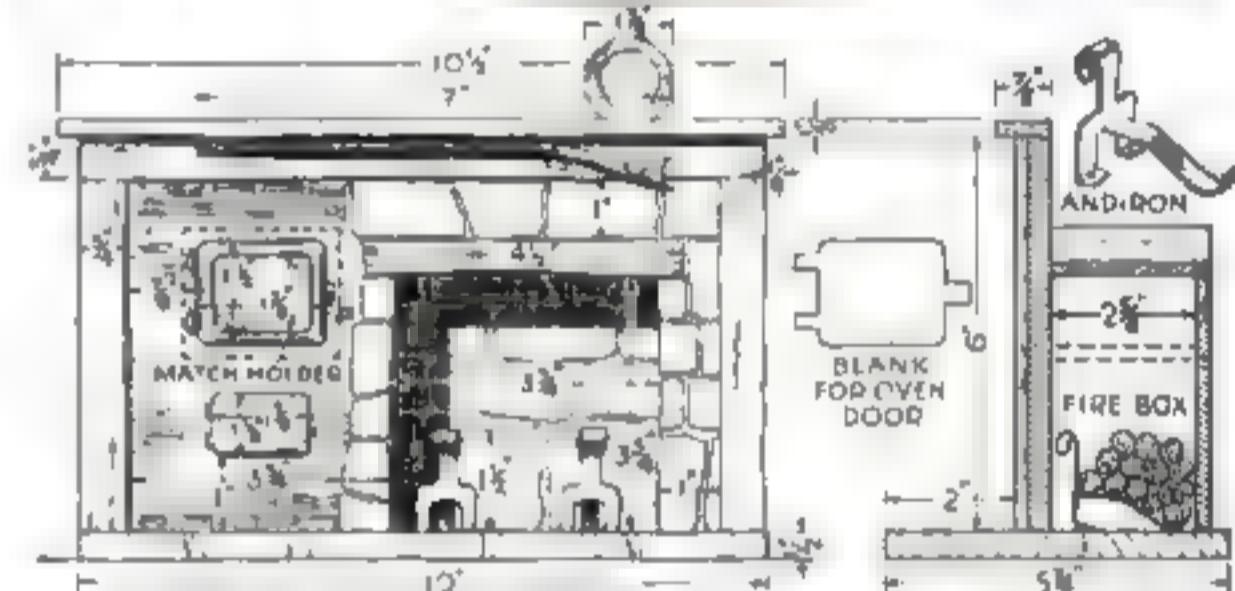
It is best to hold the brush firmly and revolve the chuck on the bench.—J. H. DEERY

MASHING UP WHITE LEAD

If you mix your own paints with paste white lead, you can save yourself considerable labor in breaking up the white lead by using an ordinary ten-cent wire potato masher.—R. E. WISNER



This miniature fireplace built from wood and fiber wall board is a good example of how to make a cigarette container.

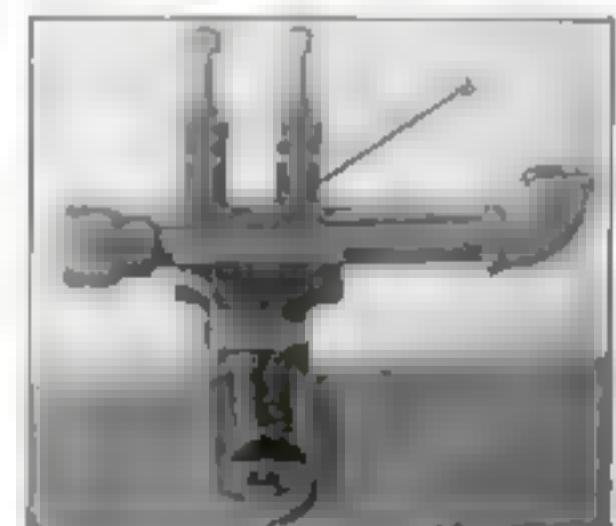


SHELLAC MENDS CRACKED FOUNTAIN PEN CAP

Fountain pen caps often become cracked in such a way that they will no longer stay on the pen body. If the crack is not too bad, it may be repaired by brushing shellac around the cap at the point of the break and then winding on some fine, strong thread. Keep the turns close together and make what is known as an "invisible" ending. Finally, apply shellac to the binding. When the shellac is dry, it will be found that a durable repair has been effected.—H. HENRY

HOLDING PIPE SECURELY IN SMALL BENCH VISE

WHEN connecting up a new gas stove I needed a pipe vise. My small bench vise would not hold the pipe, but I made it do, nevertheless, by supplementing it with a pair of small clamps and a broken flat file as shown in the illustration below. With this set-up, the pipe was gripped in four places, and it did not turn or creep out of the vise when I applied the leverage necessary to tighten the joints.—W. M.



Pipe held in vise with clamps and a flat file.



Push food not eaten by the feeding ring drops into the triangular space at bottom

AQUARIUM HAS TRAP TO CATCH SURPLUS FOOD

DECAYING fish food is a constant source of pollution and trouble in many aquariums. Not being able to talk the fish can't tell you how much they want and if you give them too much, the left-over material starts to decay in a short time.

The use of a floating feeding ring, obtainable at any aquarium supply store, is a help because it keeps the food in one spot till the fish eat it or it sinks to the bottom. The photograph above shows an addition that still further simplifies the problem. The sand, under the corner where the feeding ring floats, is pushed back and held in that position by a thin strip of glass set diagonally across the corner. The water-logged food drops into this clear spot and if not eaten, it can be siphoned off without removing, at the same time a large portion of the sand from the bottom.—E. D. P.



The cement is applied liberally inside the glass and then coated with dry sand to form a rough outer skin

SANDER TRIMS PICTURE PUZZLE EDGES

OFTEN it is difficult to find a method of trimming the edges of a jigsaw puzzle smoothly unless an extra table with a guide fence is added to the saw. A neat way to do this is to pass the edges of the puzzle against a fast cutting disk sander. A guide is not necessary; skill in moving the puzzle and at the same time keeping it flat against the disk, is quickly acquired. Even relatively large picture puzzles can be trimmed accurately in this way.—G. S. G.



HEAVY STOCK CUT ON SMALL JIG SAW



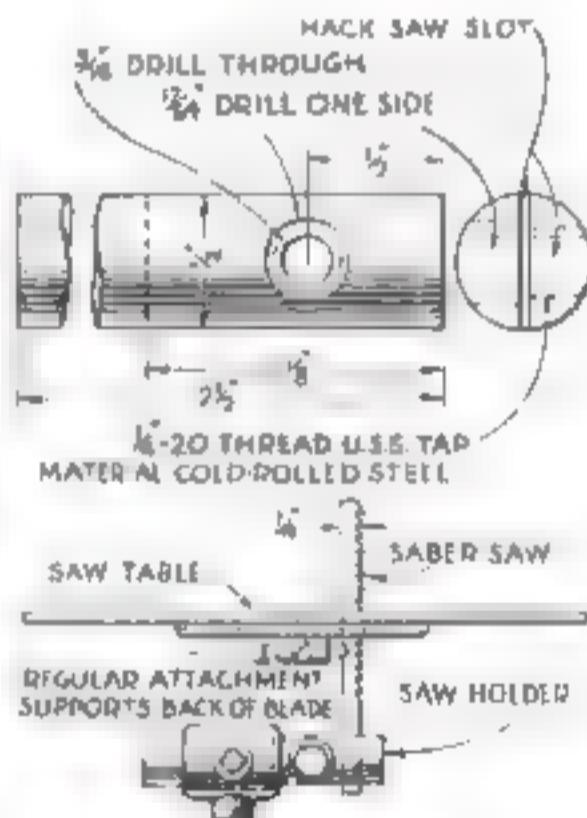
ONE of the small jigsaws in common use may be converted into a saber saw by substituting the attachment shown for the saw frame. The vibration will then be decreased and much heavier work can be handled. I have sawed 1½ in. thick white pine with ease on the saw illustrated.

The new saw holder consists of a piece of cold-rolled steel $\frac{1}{2}$ in. in diameter and $2\frac{1}{2}$ in. long. Cut a hacksaw slot $\frac{1}{4}$ in. deep across the center of one end. Then $\frac{1}{2}$ in. from this same end, drill a $\frac{1}{4}$ -in. hole through at right angles to the saw slot. Redrill one slot $1\frac{1}{4}$ in. as far as the saw slot. Drill the other side with a $\frac{1}{2}$ -in. 20-thread U.S.S. tap material, cold-rolled steel.

Inserting the tap through the $1\frac{1}{4}$ -in.

hole as a guide. Insert a $\frac{1}{4}$ -in. 20-thread cap screw $\frac{3}{4}$ in. long, with a washer under its head.

A hold-down finger need not be used for most work. If saber saws cannot be obtained conveniently, use short sections of old $\frac{1}{4}$ -in. band saws or pieces of turning saw blades.—E. C. WITTICK



REPAIRING AQUARIUMS THAT LEAK

ALTHOUGH the commonly recommended method of repairing leaks in aquariums is to push cement into the cracks from the outside, this procedure has its disadvantages. A sure cure for all leaks, no matter if the aquarium is leaking at every joint, is to force a strip of aquarium cement into the angles formed where the glass panes join on the inside of the aquarium. After you have forced the cement into a smooth radius, pour some dry sand into the aquarium and rub this gently into the streaks of cement as shown in the accompanying illustration. The sandy outer layer helps hold the cement in place.—L. R.



TINY SAFE IN BED LEG

BECAUSE of a secret hiding place I have in a hollow leg of my metal bed I have on two occasions saved cash and jewelry from loss. To make such a compartment, remove the caster from one of the legs at the foot of the bed and obtain a short tube that will fit snuggly inside the post. Slide this tube to the springs which hold the caster in place. It is somewhat inconvenient to have to lift the corner of the bed to remove the caster and tube, but the hiding place is not likely to be discovered by a burglar and it is also comparatively fire-proof.—A. V.

We Make Masts and Yards

BY CAPTAIN E. ARMITAGE McCANN

NOW we are ready to make the masts and yards and start rigging our model of the picturesque Elizabethan galleon *Revenge*. In the two preceding articles of this series (P.S.M., Apr. '33, p. 65, and May, p. 67), we said something about what a famous fighting ship this was, but as an inducement to new readers to build a model of her, it is worth while repeating that her name is one of the greatest in all naval history. Her most heroic fight was her last, in 1591, when she battled fifty-three Spanish galleons. Her commander was Sir Richard Greynville, an ancestor of Sir Walfred T. Grenfell, M.D., who has so long been fighting disease among the Eskimos of Labrador.

Those who missed the previous installments should look them up. Full size blueprints also can be obtained to make the work easier. In connection with the sail plan, it should be noted that the parts are identified by numbers, and the complete key is given on page 81. This table also shows the sizes of the rigging cord. These are indicated by the letters *a*, *b*, and *c*. Size *a* (heavy) should be about equal to No. 18 (B. & S.) gage wire, size *b* (medium) to No. 22 wire, and size *c* (fine) to No. 30. Hard-laid linen cord is best, such as fishline. The standing or fixed rigging should be black or very dark brown, and the running rigging a natural color or light brown. For the medium size rigging, use $\frac{1}{4}$ - and $\frac{3}{16}$ -in. blocks, and for the light, $\frac{1}{8}$ -in. blocks.

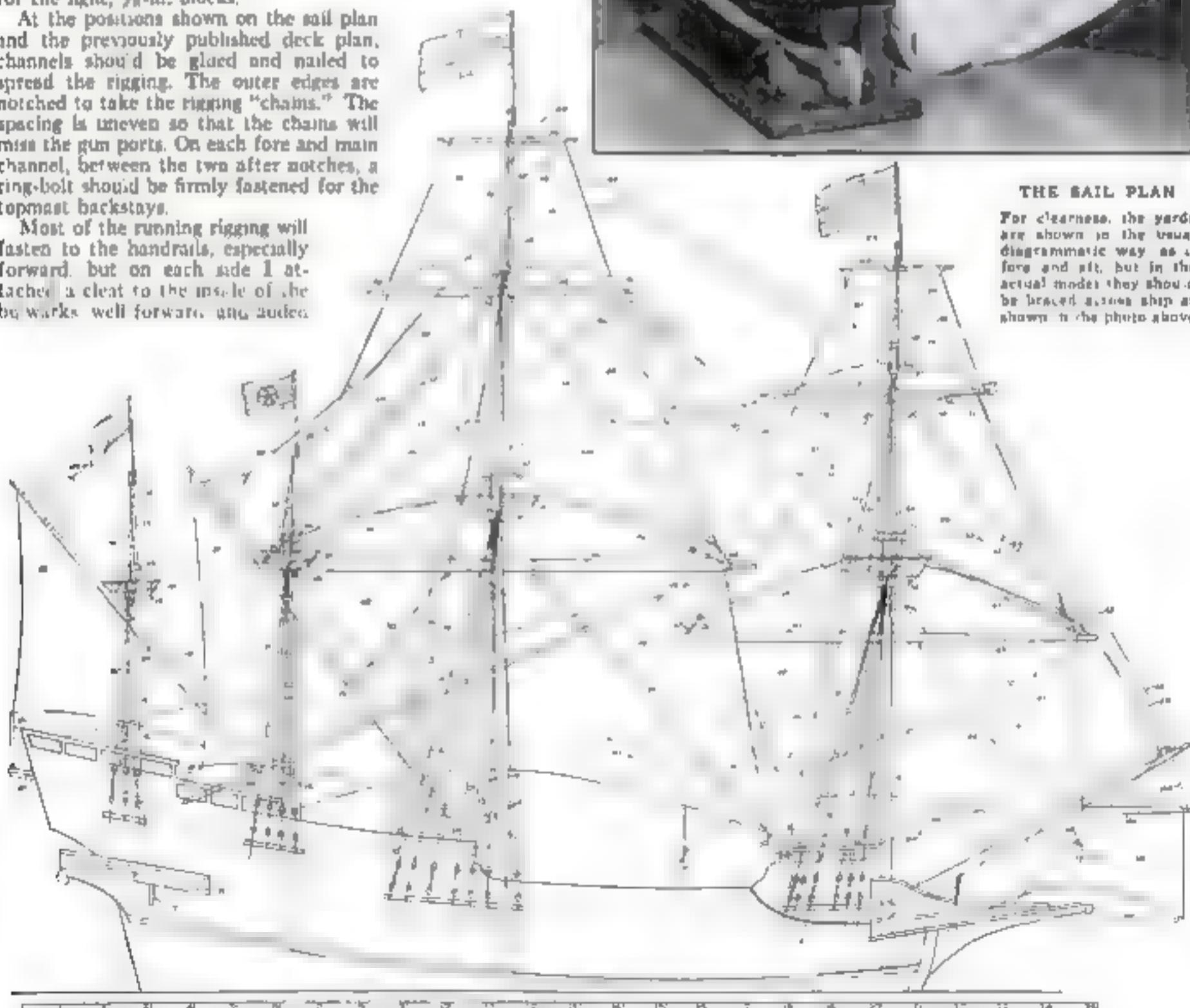
At the positions shown on the sail plan and the previously published deck plan, channels should be glued and nailed to spread the rigging. The outer edges are notched to take the rigging "chains." The spacing is uneven so that the chains will miss the gun ports. On each fore and main channel, between the two after notches, a ring-bolt should be firmly fastened for the topmast backstays.

Most of the running rigging will fasten to the handrails, especially forward, but on each side I attached a cleat to the inside of the bulwarks well forward and added



THE SAIL PLAN

For clearness, the yards are shown in the usual diagrammatic way as if fore and aft, but in the actual model they should be braced across ship as shown in the photo above.



for the “REVENGE” Model



This unusual view of the completed model shows the size of the lens and the arrows clearly, and show the angle at which the yards are placed.

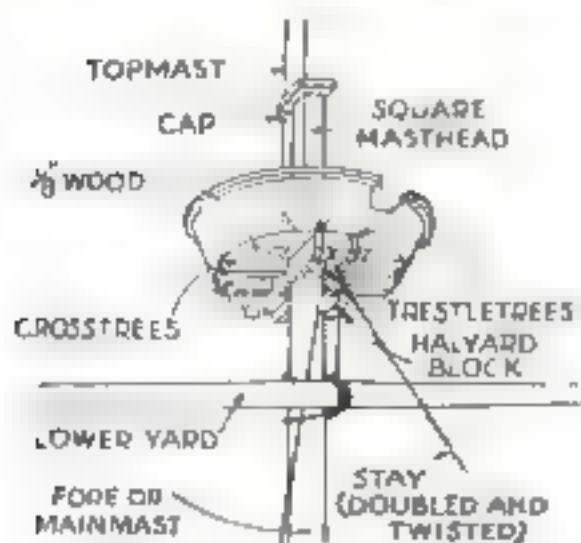
two short rails for belaying pins each side aft, with four pins on the forward one and two on the after. Drive in some eyebolts (sturdy bent-over pins) for the topgallant and tentalant halyards.

The masts are shown on the rigging plan as 1, 2, 3, and 4. The foremast is 5 in. in diameter, the mainmast $\frac{3}{4}$ in., the mizzen-mast $\frac{1}{2}$, and the bowsprit 3 1/8 in. They each taper slightly to the top. The bowsprit is 5 1/8 in. and tapers to half where stays 29 and 31 come. Beyond that there is a slight shoulder.

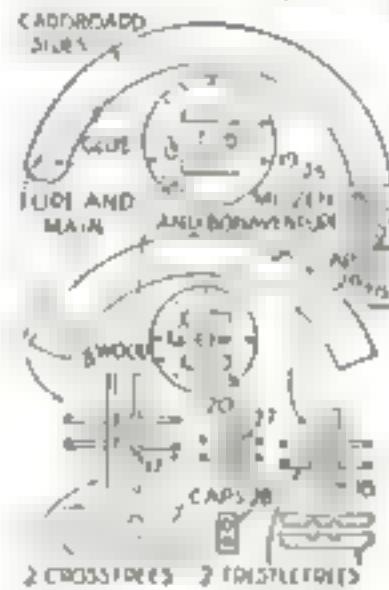
From the point where the trestletrees 17 and 18 (fore-and-aft parts of the cross-trees) are to be placed, the masts are squared to the top, and on the extreme ends a slightly smaller square is cut for the caps 25 and 26.

The lengths and diameters of all the other spars can be obtained from the full size blueprints or by scaling the drawings on page 66. The bottoms are squared at the dovetails like the lower masts, and are cut square at the heels to fit in the holes in the tops. This is easier than holding them (holding them with a

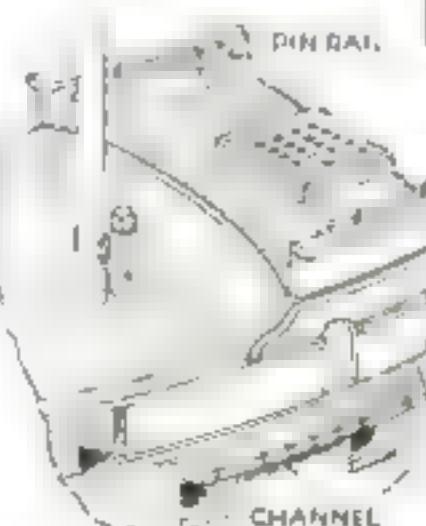
All the yarns taper from the middle to about one half the diameter at the ends.



How the mast tops and caps are set up and the lower yard baizeards are provided for.



The construction of the
various types completed
test streets, and rape

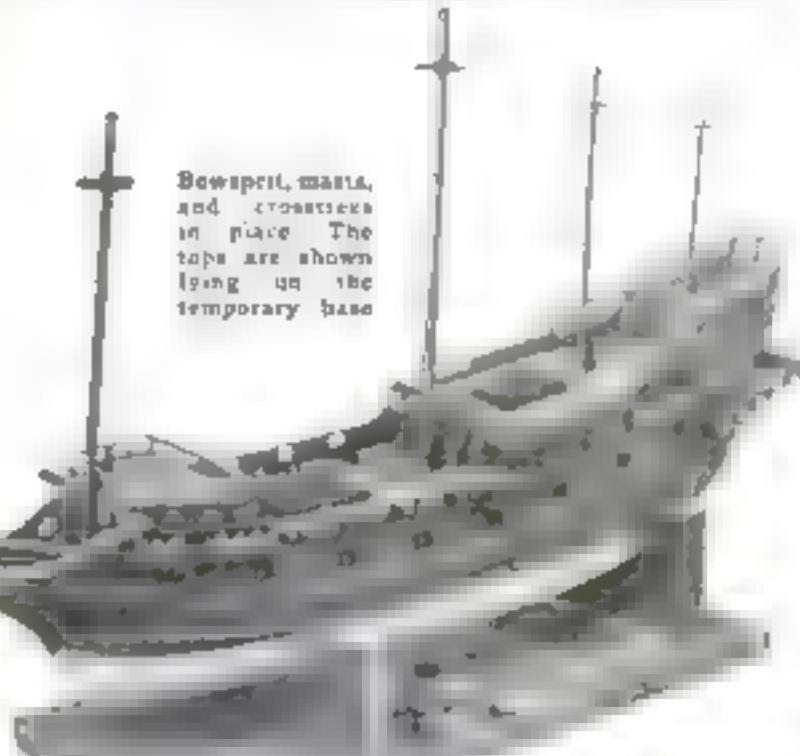


Sketch with all minor details required to illustrate the pin ribs and channels.

and have a slight shoulder at the yoke.

I made all of the spars from burch
dowel sticks and stained them light brown.
Make the lowermasts long enough, of
course, to go to the bottom of their holes,
which, it will be noticed, are of different
depths. Do not place them yet.

*And get the channels, crosstrees,
trestletrees, tops, and caps ready
to set up her picturesque rigging*



Bowspur, which
had started
in place. The
taps are shown
being up the
temporary base



Heads of the males. Note how the brows are placed at one side of the foremant and is flushed with the surrounding

Having made the spars abt the bowsprit and pass the gravingong & This is a piece of the heaviest cord passed from a notch on the bowsprit through the grating and through the slot in the beak. Get it so tight that the bowsprit is slightly bent.

Make the crosstrees shown at 17 and 18 ("crosstrees" meaning the whole assembly). These are pieces of hardwood half-lapped into each other to fit tightly on the square of the masts, where they are glued and, for preference, also nailed with a $\frac{1}{8}$ -in. pin. Those marked 17, for the fore and main, are the same; and those marked 18, for the mizzen and bonaventure, alike, only smaller.

On the crosstees rest the tops. These are circular pieces of wood cut at a bevel, and around them are glued pieces of Bristol board of the shape shown, so that they will flare out. Around the top edges are glued thin pieces of chair caning spline or cardboard. They (*Continued on page 81*)

It's Easy to Make Cardboard Boxes for Puzzles and Novelties



The boxes and covers are mounted with water glass and held with spring clothespins.

UNIFORM, attractive boxes are necessary in the marketing or presentation of jigsaw puzzles and other small wooden novelties made in the home workshop. Box prices are usually about a dollar a dozen, but by the following method it is possible to make first-class sturdy boxes at a net cost of about three for five cents.

The boxes illustrated hold a 300-piece puzzle nicely, and three are made with but little waste from a 22 by 28 in. sheet of six-ply white enameled or colored cardboard. From each sheet cut three pieces $8\frac{1}{2}$ by 11 in. for the tops, and three pieces $8\frac{5}{16}$ by $10\frac{13}{16}$ in. for the bottoms. These are held together with one corner squared up, and a $1\frac{1}{2}$ in. long cut is made on the scroll saw $1\frac{1}{2}$ in. from the edge, as shown. The other corners are squared up one at a time, and cut in the same manner.

A scoring board is next made. This is a piece of veneer or other smooth mate-



Three of these neat boxes, which hold 300-piece wooden jigsaw puzzles, are made at a cost of about five cents.

rial about 11 by 15 in. with a 1 16 in. deep saw cut made in the surface at a distance slightly more than $1\frac{1}{2}$ in. from one of the longer edges, as illustrated in one of the small diagrams at the right. Two small brads are placed exactly $1\frac{1}{2}$ in. from the saw cut to serve as guides. The scoring tool is a metal nut pick, ground down to a blunt smooth end.

To score the cardboard, lay it on the board and press one edge against the brad guides as illustrated in one of the photographs. Then use considerable pressure to

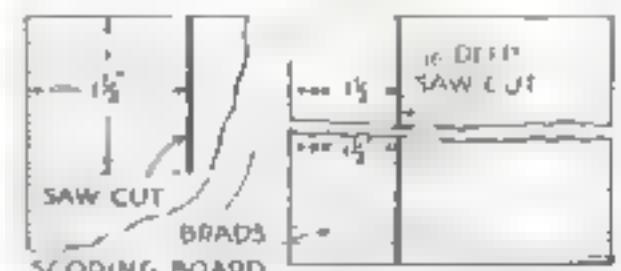
Six cardboard pieces—three for bottoms and three for covers—are squared up, and a cut is made at each corner $1\frac{1}{2}$ in. from the corner and $1\frac{1}{2}$ in. long, as at the left. The bending lines are later scored with a blunt nut pick as illustrated below.



force the cardboard down in on the saw cut with the tool. To prevent cracking the cardboard, moisten it with a damp bit of cloth on the opposite side before scoring. A single quick wipe along the score lines is sufficient. To lubricate the tool it may be rubbed on a cake of paraffin.

The edges of the cardboard are now bent up, and the corner flaps given a thin coat of water glass (solution of sodium silicate) and

clamped in place with spring clothespins. Only a minute is required for drying, so a large supply of clothespins is not needed.—KENNETH MURRAY



SMOOTHING GLASS AQUARIUM COVERS

The glass covers used on aquaria stocked with tropical fish are a potential source of danger every time you handle them. A slight slip and the sharp edges are likely to cut ugly gashes in your fingers. To smooth the edges, hold the glass vertically by one edge, using your handkerchief or an asbestos pot lifter to protect your hand, and rub the upper edge with a piece of triple-O emery cloth as shown at the right. Pay particular attention to the sharp corners. Treat each of the four edges in the same way and you will have a piece of glass you can handle without fear.



Using a piece of emery cloth to smooth the sharp edges and corners of the cover glasses for a tropical aquarium.

LONGER LIFE FOR JIG-SAW BLADES

WHEN the finer sizes of jig- and scroll-saw blades break frequently the cause is often unnecessary wear rather than poor quality steel. Slotted guide wheels, in particular, are likely to wear away both the sides and back of the blade. Examination of broken blades will often show that they have been worn extremely thin. This can be avoided and the blades made to last much longer by using the V notch of the guide wheel and setting the blade so that it makes contact with the guide only when work is being fed against it. Let it run entirely free at other times.

Camper's Folding Frying Pan

By Leonard F. Merrill

Expert outdoorsman and writer

FRYING pans are a necessity of the trail that few outdoorsmen care to do without. The ideal pan, of course, is one with a folding handle that can be stowed away conveniently in a pack or knapsack. In these days, few of us care to buy an expensive folding pan such as those offered by sporting goods dealers, but the pan to be described is just as efficient in every way and costs only 18 cents.

Materials A sheet iron frying pan from the 5-and-10-cent store (they come in three sizes), one $1\frac{1}{2}$ -in. butt hinge, six short flathead stove bolts, six nuts for the bolts and one corner iron $1\frac{1}{2}$ by $1\frac{1}{2}$ in.

Tools, Tinner's snips, a file, a drill that will make a hole large enough for the stove bolts, a screw driver, hammer, and pliers.

Method Cut the handle from the pan as nearly even with the rim as possible. Flatten the lower end of the handle, and square and trim the end and sides of the flattened part. Trim the rim of the pan where the handle was removed.

With the handle in place at the rim of the pan, hold the hinge on the inside of the pan and on the upper side of the handle. Mark the centers for the holes. Drill the holes and fasten the hinge in place with four stove bolts.

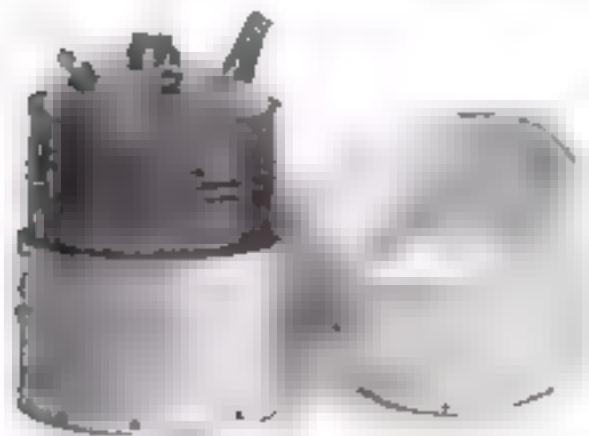
Cut one end of the corner iron off between the two holes. Bend this short side or end out to form an angle of about 120 deg. With the long end of the iron on the underside of the handle, slide the iron down until the short end comes in contact with the side of the pan. If the handle is not at the angle desired, bend the short end until the slant is satisfactory. Hold the brace in place and mark the centers of the two holes in the long end of the iron. Drill corresponding holes in the handle and fasten the iron to the handle with the two stove bolts which were not used before.



When everything is satisfactory and the nuts are as tight as possible, file the ends of the bolts off until only about $1/16$ in.

remains beyond the nuts, then head over the ends of the bolts with a hammer as you would a rivet.

CARRYING EXTRA GAS IN SMALL BOATS



For carrying an extra supply of gasoline on a 14-ft. outboard runabout, I use four individual holders like the one illustrated above. They are screwed to the floor in a row running across the boat just back of the front seat and are kept covered with

good-looking rubberized cloth. Each holder is merely a strip of galvanized sheet iron with a turned-over edge, bent and fastened to a round piece of wood, which forms the bottom. I soldered the seam up the side. The gasoline cans are of regulation design, and each holds two gallons, or eight gallons in all.—F. F. Wilson.

CEMENT EDGINGS HELP IN TRIMMING LAWN

A LITTLE cement properly used next to curbs, walls, clothesline posts, or any objects located in the lawn will save much hand trimming with the shears. Dig a trench 3 in. deep and 5 in. wide along the curb or around the object and fill it with a mixture of one part cement, two parts



sand, and three parts gravel. Then the mower can cover the edges of the grass, as shown in the photograph above, and keep it looking neat without the need of trimming by hand.—Lewis Shirley.

Embossing Your Own Prints

*and other hints for
AMATEUR PHOTOGRAPHERS*



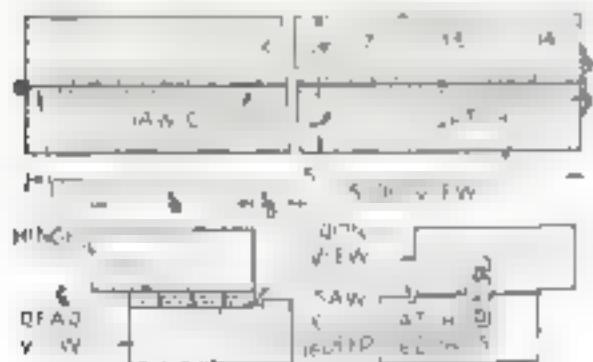
The print is clamped in the embosser and a pointed stick serves as the embossing tool.

AMATEUR photographers can emboss their prints neatly with the simply made device illustrated above. The materials required are two pieces of white pine or some other soft-wood $\frac{3}{4}$ by $1\frac{1}{2}$ by 15 in. and a small 1-in. hinge. The two strips are laid together and offset $\frac{1}{2}$ in., then a line is drawn with a pencil on each projecting side. In one piece a groove $\frac{1}{16}$ in. deep is cut along the line with a saw. Another groove is cut along the line in the other piece to the same depth, but in this piece the wood between the groove and the edge of the strip is removed with a chisel, forming a rabbet, as shown in the drawing below.

The pieces are then laid together in the proper relationship, and the mortise for the hinge is marked and cut at one end. At the other end a hook or latch of wire or thin brass is attached.

To emboss a print with a line, the grooved side is used. Clamp the margin of the print in the embosser as shown in the photograph, then draw a pointed stick over the groove. This pushes the paper into the groove and gives a neatly embossed line. By using the side with the rabbet in the same way, the print can be given a paneled effect, with the middle of the print set below the margins.

For measuring the edge of the embosser is marked as shown.—FRANK WILDING



EASTMAN NEWS BULLETIN FOR THE AMATEUR PHOTOGRAPHER

JUNE, 1933, PUBLISHED BY EASTMAN KODAK COMPANY



INDOOR SNAPSHOT SPEED

Kodak Super Sensitive "Pan" is 50 per cent faster than even Verichrome Pan in morning and afternoon light.

It is THREE TIMES as fast under electric lights. Makes pictures indoors at snapshot speed with low-cost Photoflood lamps.

Picture above: 1/60 second, f/4.5, two Photoflood lamps in reflectors.

NOW—Kodak Super Sensitive Panchromatic Film in ROLLS and PACKS

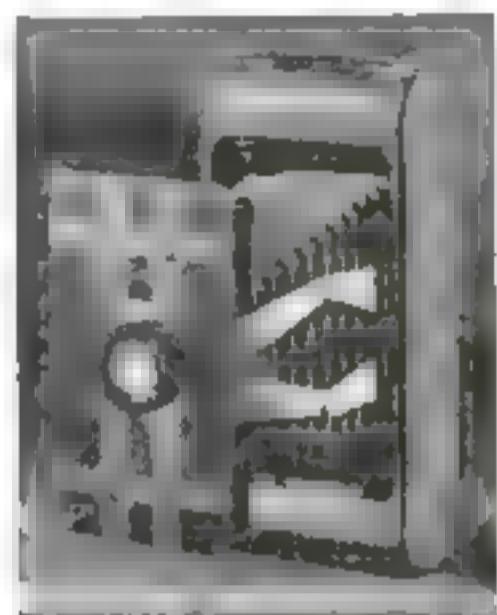
Photo fans everywhere—Here it is!—An ultra-fast, fully panchromatic film for roll film and film-pack cameras.

So fast that it makes INDOOR SNAPSHOTS easy. Sensitive to all colors. Gives true visual brightness to all subjects...permits special tone effects with filters.

Opens new picture possibilities to all cameras. Gives utmost scope to the new fast Kodaks.

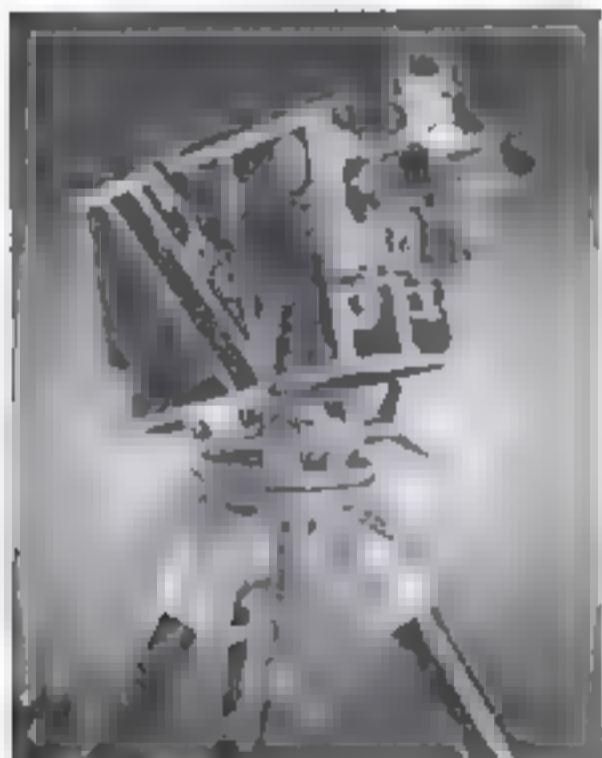
Order a supply of this marvelous new film today. At your Kodak dealer's.

Green lightning
on the yellow bus
is now possible
with Kodak Super Sensitive Panchromatic Film.



POP-IT OPENS

The new Jiffy Kodak simplest folding camera ever devised. Touch one button. It pops open, all set for action. Touch another. Click! It snaps the picture in clear, sparkling detail. Smart in action. Smart in appearance. Compact, convenient to carry. Jiffy Kodak Six-16 takes 2 1/4" pictures. See it at your dealer's. Price, \$7.50.



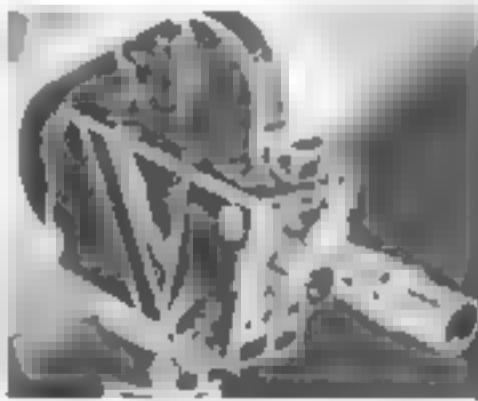
NEW CINÉ-KODAK OF AMAZING SCOPE

Fade-ins, fade-outs, dissolves, animations, variable slow motion, and multiple exposures are but a few of the unusual movie effects easily achieved by the new Ciné-Kodak Special—the most advanced of all 16 mm. movie cameras.

The Ciné-Kodak Special has spring, electric, and hand drives for normal, slow motion, or single frame exposures. Reverse wind permits double or multiple exposure, dissolves, etc. Double lens turret with exposure scales and finders, focal plane focusing, adjustable shutter for fast action shots. Speeds from 8 to 64 frames a second. Interchangeable 100- and 200-foot film chambers. Send coupon for the Ciné-Kodak Special booklet, describing other features of this versatile camera.

Left: Ciné-Kodak Special with 200-foot film chamber, no tripod. Note double lens turret controls on side panel, and adjustable tripod head.

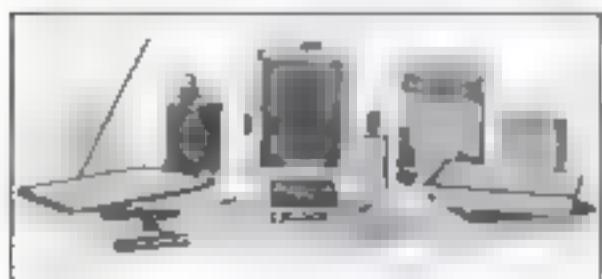
Right: The Special with 200-foot film chamber attached. Instantly interchangeable with the 100-foot chamber. Permits over 8 minutes of picture taking without reloading. Chambers can be changed without loss of film frames.



LIGHTS UP!

This low-cost Kodalite reflector gives you abundant light for indoor pictures. With the new Super Sensitive film, it makes snapshots and movies at night easy and certain. Permits making Kodacolor movies indoors. Uses two Photoflood lamps, mounted with reflectors on a light, swivel-head stand. Reflectors lie flat when not in use. Stand telescopes to small space. Price, \$5.

If it isn't an Eastman,
it isn't a Kodak



FOR THE HOME DARKROOM

Here's a real hobby—making your own snapshots. Kodak Darkroom Outfit No. 1 above contains everything you need for developing films and making prints. Complete with durable black fiber case and instruction book, \$4.75. Send coupon for catalog describing this outfit and other photographic equipment.



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Ciné-Kodak Special
Booklet

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Street _____

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A GRACEFUL Monoplane MODEL

Simplified for Beginners

NINETEEN easily made units are all the parts required to build this graceful wooden model of a Fairchild cabin monoplane. Nails, rivets, and washers, of course, are not counted. The scale of the model in relation to the full size plane is $\frac{1}{16}$ in. equals 1 ft.

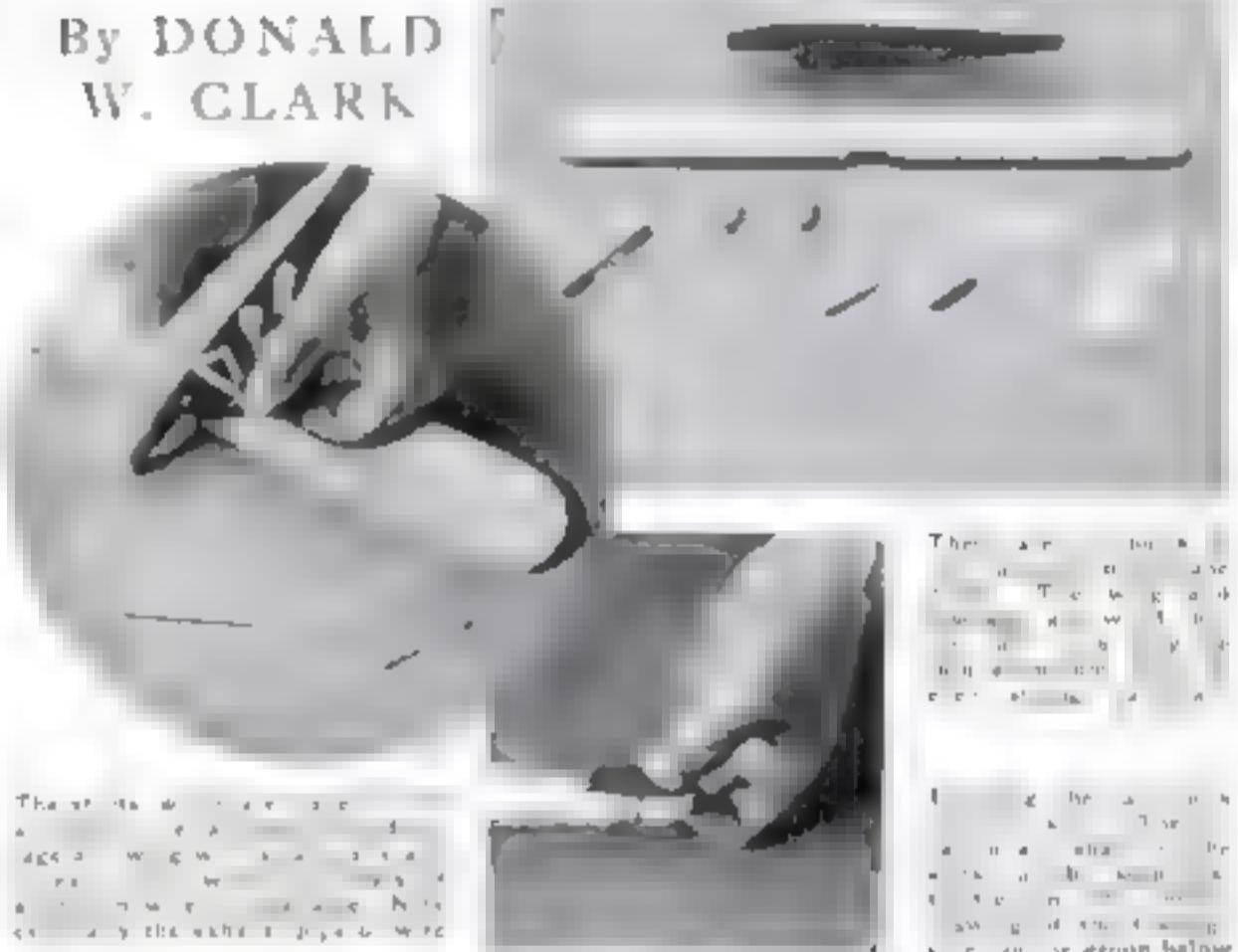
Saw out and plane a white pine block to 1 by $1\frac{1}{2}$ by $8\frac{1}{2}$ in. Mark the fuselage profile and top lines, saw the horizontal and vertical tail slots, and carve the block to shape. Drill four $3/32$ -in. holes in the bottom of the front end to take exhaust pipe *E*, and a hole at the tail for the rear wheel, which is held in with match stick wedges.

Cut the wing from a piece $3/16$ by $2\frac{1}{4}$ by 15 in. Saw out a notch in the middle of leading edge as shown. Mark the aileron lines and press them in with the back of the knife point. Cut the tail units from thin aluminum, fiber, or stiff cardboard.

Make all the struts of thin aluminum. Measurements are given from bend to bend except in a few cases where the bend-to-hole centers are dimensioned. The two front wing struts have holes $1\frac{1}{8}$ in. from the bottom bend to take rivets for fastening struts *B* and *D*.

The wheels are made of 3. 16-in. wood $\frac{1}{4}$ in. in diameter. They can be made without a lathe. Simply draw the circle, cut to shape with a knife, and finish with sandpaper. Roundhead nails serve as axles,

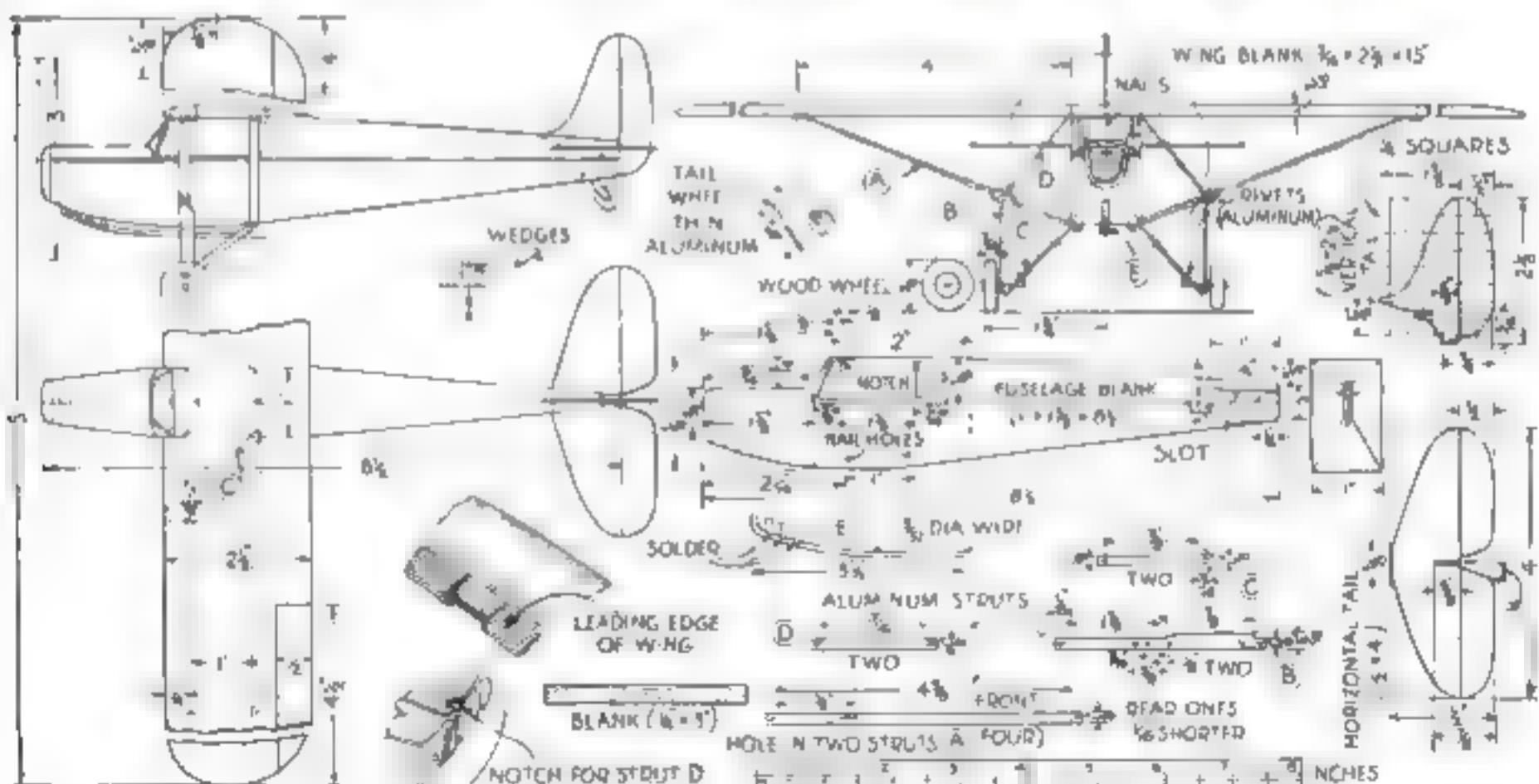
By DONALD
W. CLARK



the ends of which can be either flattened or touched with solder.

The model will look well if painted as follows: Fuselage, propeller, vertical tail,

all struts, and tail-wheel fork, bright red; wing, horizontal tail, wheels, radiator, and windows, buff; tires, black. The exhaust pipe should be polished.



DANCING ON GLASS

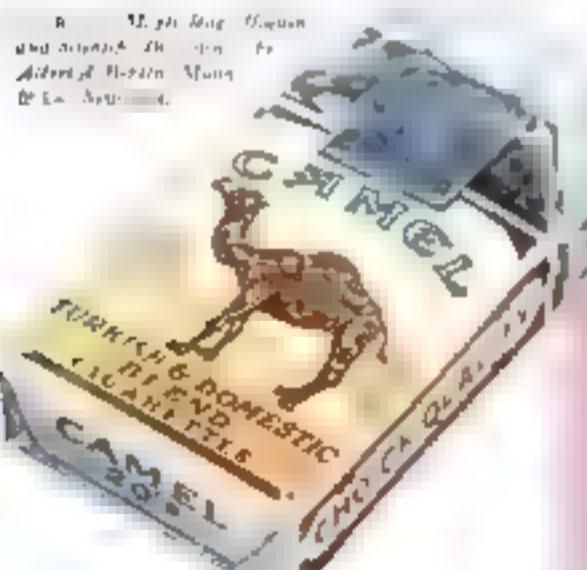


ILLUSION

In India the fakirs present a similar illusion. They walk upon sharp glass. They step barefooted upon the glass and do acrobatic dances uninjured.

EXPLANATION:

Before appearing the performers roughen their feet in a solution of alum water and rub them with pulverized resin. They throw the sharp glass over the edges of the platform. The glass on which they actually dance has the edges ground off. They just pretend to dance on the sharp glass.



KEPT FRESH IN THE
WELDED HUMIDOR PACK

IT'S FUN TO BE FOOLED ... IT'S MORE FUN TO KNOW

One of the tricks of cigarette advertising is to pretend that "Heat Treatment" is an exclusive process, making one cigarette better than any other.

EXPLANATION: All cigarette manufacturers use heat treatment. The first Camel cigarette ever made, and every one of the billions of Camels produced since, has received the necessary

heat treatment. Harsh, raw tobaccos require intensive processing under high temperatures. The more expensive tobaccos, which are naturally mild, call for only a moderate application of heat.

It is a fact, well known by leaf tobacco experts, that Camels are made from finer, MORE EXPENSIVE tobaccos than any other popular brand.

Try Camels. Judge them critically. Compare them with others for mildness, for throat-ease, for good taste. They'll win you!



**NO TRICKS
— JUST COSTLIER
TOBACCO**

IN A MATCHLESS BLEND



NOW YOU'LL BE 3 TIMES SAFER FROM BLOW-OUTS AT HIGH SPEEDS

**See how this utterly new way
of making tires prevents blow-
outs by overcoming the CAUSE
of blow-outs before they start**

WHEN your speedometer reads 40, 50, 60 and 70 , mile after mile the heat *inside* the tire becomes terrific. Rubber and fabric begin to separate. A blister starts and grows bigger and bigger, until BANG! A blow-out! And a terrible drag pulls your car off the road.

How it prevents blow-outs

To protect you from blow-outs, every new Goodrich Safety Silvertown Tire has the amazing Life-Saver Golden Ply. This new invention resists heat. Thus, rubber and fabric don't separate. Busters don't form. The cause of blow-outs is eliminated before they start.

Three times safer

At grueling speeds on the world's fastest track, the new Goodrich Safety Silvertown, with the Life-Saver Golden Ply, lasted 3 times as long as first quality tires that did not have this feature. These SILVERTOWNS

never blew. They were run till the wind was gone—but the Life-Savers (Goddard Ply) refused to give up.

Don't think that slower driving can save you from blow-outs. Long trips at 35 or 40 miles an hour can generate terrific heat, too. To be safe, have the protection of the Life-Saver Golden Pig. It's Free! Just make sure you buy a SILVATRON® Tire, which costs not a penny more than other standard tires.

Isn't this the kind of tire you want for your car? Then decide now to equip your car with Goodrich Safety Silvertowns—the only tires in the world built with the Life-Saver Golden Ply.

Look up your nearest Goodrich dealer's name under "Tires" in your classified telephone directory. Put *real* protection between yourself and the road . . . for your family's sake and your own!



FREE! This handsome Safety League emblem with red crystal reflector to protect you if your tail light goes out. No obligation. Just join the Silverton Safety League. Endorsed by Traffic Officials. Write today. Dept. 136. The B. F. Goodrich Rubber Co., Akron, Ohio.



The NEW

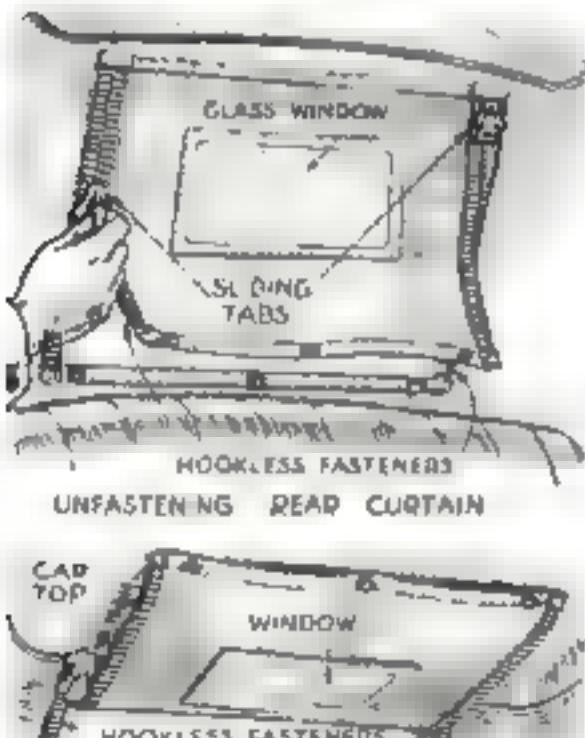
Goodrich Safety Silvertown

Copyright, 1933, The B. F. Goodrich Rubber Co.

The Month's Best AUTO IDEAS

Hints, Useful to Car Workers,
Are Supplied by Our Readers

REAR window flaps on coupes and convertible roadsters can be made draft proof and rainproof by applying strips of hookless fasteners to the side joints. Ordinarily, the rear flap is provided only with three hooks along its bottom edge. As shown in the illustration below, the hookless fasteners which can be purchased new or salvaged from old pieces of clothing, hand luggage, and so on, are stitched to the sides of the flap and the edges of the car top. Merely pulling the sliding tabs up or down opens or closes the flap. Obviously, the fasteners should be sewed in place so the open end is at the bottom. The hookless fastener strips can be stitched with carpet linen threaded in a tailor's needle.—C. F.

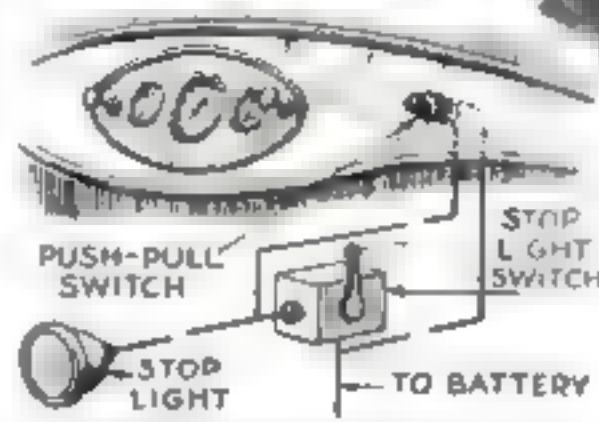


Hookless fasteners, stitched to the side of window flaps, will make your roadster rainproof

New Backing Light

BY CONNECTING a push-pull switch across the stop-light switch terminals, you can use your stop light also as a backing light. In the closed position, the push-pull switch completes the stop-light circuit independent of the brake and allows the light to be used when backing. When the switch is open, however, it does not interfere with the regular operation of the stop light by the brake pedal. To increase the illumination of the light, use a twenty-one-candlepower bulb in place of the usual type found in stop lights. The writer installed the supplementary switch on the dashboard, where it is handy for

immediate use when a light is needed in backing at night on a dark road.—H. M. J.



A push-pull switch connected as shown across stop light terminals will give a backing light

Getting Your Car Out of Mud

WITH a rear wheel stuck in the mud, a plank and some stout rope or a chain used in the manner illustrated will provide the necessary traction. Place the plank as far under the mired wheel as you can get it, tie the rope or chain to the outer end, and fasten the other end of the rope to the lowermost spoke of the wheel. Then start the motor, shift into low gear, and engage the clutch slowly. The wheel in turning will pull itself along the plank for one quarter of a revolution. By taking up the slack in the rope after each try, the car can be made to pull itself out of a mud hole in a very short time.—O. G.



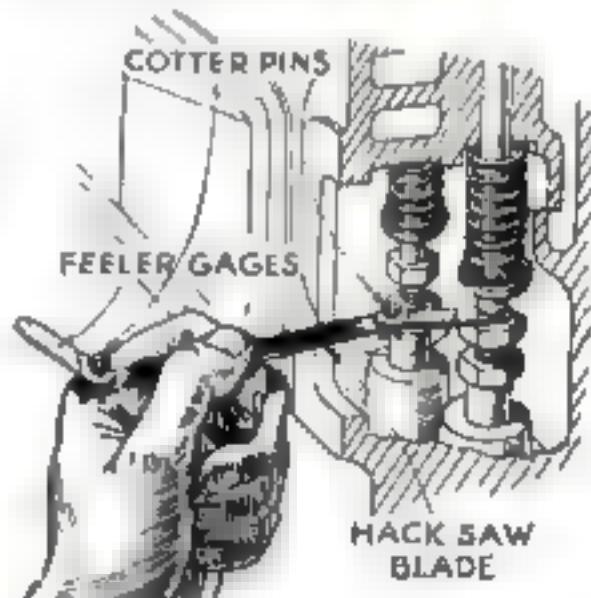
A plank and a piece of rope can be used, as shown, to free a car when wheels are in mud



On piece of wall board nailed up in garage, pages of auto kinks are pasted for reference

Auto Kink File

RATHER than lose the valuable kinks published each month in POPULAR SCIENCE MONTHLY, I now clip out the page and glue it to a board fastened to the wall of my garage. The board is merely a piece of wall board nailed to the studs. When I am working on my car and get stuck I glance over my work sheets and find the answer to my problem. I have also added a directory of service stations.—D. G. R.



Using Feeler Gages

WHEN adjusting the valves on a car, the shortness of the feeler gages often causes undue fuss and aggravation. The work must be done in cramped quarters and the short gage strips are difficult to handle. To overcome this, the writer removed the exhaust and intake valve feeler leaves from the gage case and fastened them to the ends of an old hack saw blade as shown. Both gages are always ready for use and the saw blade serves as a handle.—B. W.

"Roughing it"



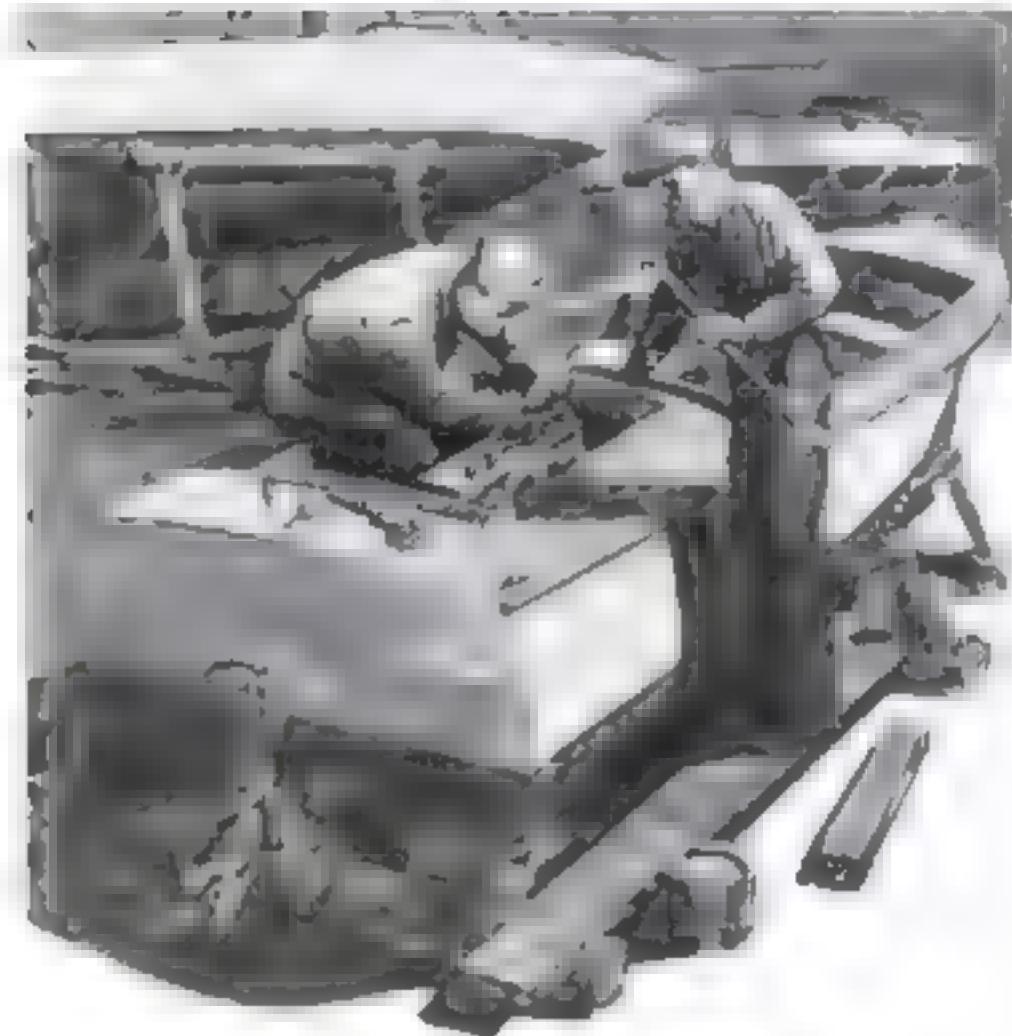
but at home you want a mattress

THERE'S a world of difference between sleeping on the hard cold ground, and nestling in a downy mattress.

For comfort you need springs, something to absorb jars and shocks. Like the springs in a mattress. Squibb Shaving Cream puts cushioned ease in shaving. The creamy lather makes the blade glide without rasps or tugs. And, after shaving, there's a velvet ease you've never felt before. For Squibb's contains oils essential to the comfort of the skin. It leaves your face smooth, pliant, and refreshed.

Send 10c for a guest-size tube to E. R. Squibb & Sons, 2306 Squibb Building, New York City.

• The right partner for Squibb Shaving Cream . . . Squibb Talcum, scented or unscented.



LATEST WAY TO INSTALL

Old Auto Engine in a MOTORBOAT

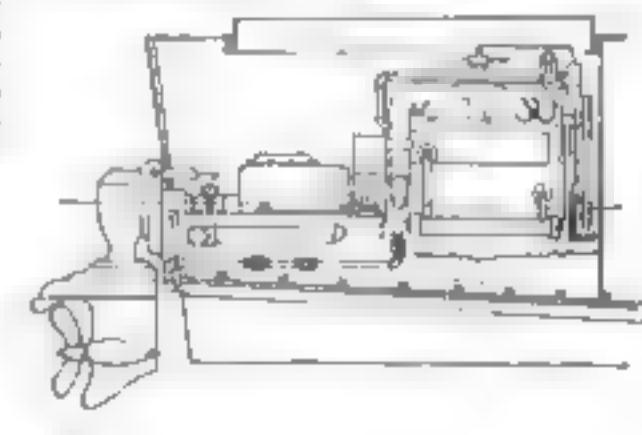
By Walter A. Papworth

I HAVE just finished installing a model "A" Ford engine in a boat in a way that offers several advantages. The engine is mounted level under the rear deck of a 21-ft. boat in a compartment 4 ft. 6 in. long, which leaves the whole cockpit of the boat free from machinery oil, and odor, and puts the engine nose behind the passengers.

This is made possible by the use of an inboard-outboard drive, of which there are several makes on the market. The drive unit has a short horizontal upper shaft which extends in through the transom and connects through a flexible coupling to the marine reverse gear bolted to the flywheel flange of the engine. At its outer end, this shaft drives through bevel gears to a vertical shaft which in turn drives the short propeller shaft through another pair of bevel gears. The drive unit turns for steering, and is braced (with a shear pin) so that it can swing up if it hits anything, or for beaching the boat.

Such an arrangement avoids two troubles commonly encountered where automobile engines are used in boats with the conventional inclined shaft drive—oil leakage, caused by the fact that automobile engines are not equipped with oil seals suitable for the degree of inclination required, and the necessity of mounting the engine abnormally high in the boat because the flywheel is at the driving end.

Front and rear marine brackets were cast in brass from my studio lamp base. Middle bracket is made of aluminum and is attached to the front and rear brackets by bolts at the engine.



REAR BRACKET



FRONT BRACKET



WATER OUTLET
BEND DOWN



WATER INLET
BEND DOWN



PUMP BRACKET

STARTER LEVER BRACKET



SPARK COIL PLATE

Explanatory drawings made by Mr. Papworth, who won third prize in our Auto Eng. contest.

mounted on a small pump bracket, held by the same cap screws which hold on the cam shaft gear cover plate, and is driven by a V-belt, which also drives the generator. The suction for the vacuum fuel tank is obtained by tapping into the suction side of the water pipe, just below the pump.

AN OIL cooler is quite necessary. In this case, the oil return tube was cut in two, straightened out, and welded into a piece of 2-in. pipe held horizontal just below the pump flange by a pair of sheet metal clips, also welded to the 2-in. pipe and held under two of the pan screws. Caps were screwed on the ends of the 2-in. pipe. First, however, they were bored to the outside diameter of $\frac{1}{2}$ -in. brass pipe. A straight length of brass pipe, threaded on both sides, was slipped through the caps and strongly soldered to them. At the stern end, a good vertical check valve was installed to keep the system full of water and the pump primed. Behind this, a tee was installed, the side branch having a valve threaded for the connection of a hose to pump out the bilge, and the main line aft of the tee was also equipped with a valve to regulate or cut off the direct intake of water from outside. From this valve the water intake goes out through the transom, then down below the planking, and terminates in an ell that opens forward. It will be seen that the installation avoids all openings through the boat bottom either for the shaft or for water connections.

From the front end of the oil cooler, the water pipe goes up into the pump, with the vacuum tank suction entering through a tee, thence through $\frac{3}{4}$ -in. pipe (the pump size) around to the water inlet in the side of the cylinder block, dipping below the breather pipe, and having a drain plug at the tee just below the water inlet casting. The water coming from the cylinder head enters a $\frac{1}{2}$ -in. pipe line, which runs close along the top of the exhaust manifold, and down and into the rear end of the manifold just above the clamped connection to the exhaust pipe. Like some water jacketed manifold, a sheet metal shield covering both the exhaust manifold and this water pipe gets rid of some of the heat. Aluminum castings were used for the connection of water pipes to cylinder head and block, but flat tapped plates can be used at a slight sacrifice of neatness.

FOR getting the oil out of the crank case the drain plug was tapped for $\frac{1}{2}$ -in. pipe and a line run to the side and above the oil level so that it can readily be pumped out. To make it possible to actuate the switch on the starting motor from a remote control, the control rod bracket on the rear of the engine can be worked over into a starter lever bracket by cutting off its vertical arm then heating the other arm red hot and bending it downward through about 180 degrees to provide a fulcrum for a lever bearing on the starter switch plunger, which can be actuated by a pull wire from a forward steering position. Remote controls for the throttle and choke can readily be conceived with bell cranks and rods. An automatic spark control, commercially available, fits in the timer and avoids the necessity of remote control for the spark.

The flange was cut off the front end of the exhaust pipe and welded into a 2-in. nipple, thence to starboard through a forty-five, thence astern through an ell to another ell near the transom, thence to starboard to another ell as near the side as possible and above the water line, thence out through the transom with a short nipple, drawing astern all the way.

This power plant is not suitable for light speed boats of the type usually powered with outboard engines. It will weigh around 600 pounds and will not deliver any more power than the larger outboards.



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Mr. Geo. R. Collins
.....
ESTIMATE
For repairing and
replacing rotten
wood and
trunks.....
\$17.00

"I fixed it myself with PLASTIC WOOD

and SAVED \$16

"Whoever put that quarter-round moulding on the window sill outside our sleeping porch did a bum job", writes George R. Collins. "Water leaked down behind the moulding and into a pocket. A considerable section of the sill rotted away, and caused one of the corner posts of the porch to sag slightly so that it was difficult to shut one of the porch windows. One man wanted \$17.00 to put in a new sill. Maybe that's a fair price, but a small can of Plastic Wood

made the old sill as good as new. I did it myself for \$1.00—the price of a pound can of Plastic Wood. After scraping away all the rotten wood, I applied Plastic Wood in layers, waiting till each layer dried thoroughly before putting on the next application, and then painted it to match the wood-work. My wife is proud of me—but Plastic Wood deserves all the credit

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Plastic Wood is *actual wood*—and yet you handle it like putty! Even if you've never used it before, you'll find it easy to do expert finishing and repair work with this amazing preparation. It's a household necessity with handy men, because they can depend on Plastic Wood for doing a thousand odd jobs—and doing them all perfectly. Comes in 9 different colors—on sale at all good hardware, painter and department stores in cans or tubes. Try it today!

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Tested again and again, Nicholson Files measure up with the extra quality and strength which mean faster cutting, greater durability, longer precision, and greater economy on each filing job.

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FILES

A FILE FOR EVERY PURPOSE

Spinning Metal WITH SECTIONAL CHUCKS

By Herbert Woolsey



These sugar bowl and cream pitcher were spun from copper, fired with manganese, and chromium plated. The lid of the sugar bowl, knob and spout were formed from separate pieces.

SECIONAL chucks employed by the metal spinner are forms that can be taken apart and removed piecemeal from the inside of a blank of such a shape that a solid chuck could not be withdrawn from it. Cream pitchers and sugar bowls with sides greater in diameter than the opening are familiar examples of work requiring sectional forms. Other examples include automobile hub caps, an endless variety of hollow knobs, teakettles, and similar utensils.

Although sectional chucks used by the professional spinner are ordinarily made of metal, they can be constructed of hard wood. The parts are so joined so that the largest parts can be removed from the work after it is spun. The pieces are glued together with a layer of paper between the joints, that is, a strip of paper is coated on both sides with glue and used to join two pieces. The completely glued-up block, in the

form of a disk or cylinder, is placed in the lathe and turned to the desired shape. The pieces are then knocked apart, the paper making it fairly easy to separate them.

Because metal sectional chucks are more satisfactory, the making and using of a typical one will be discussed. The example chosen is a toy pitcher that holds enough cream for a cup or two of coffee. Such a pitcher also makes a toy that will please any little girl.

The production of the pitcher is a two-step process, as are the majority of spinning jobs performed on sectional chucks. The



The one-piece form, or starting chuck, used in the first stage of spinning the small pitcher.



After the blank for the cream pitcher has been evenly spun around the starting chuck, the edge is trimmed as shown above. Next the sectional chuck is set up its segments being placed around a steel core as shown at right.



first spinning is done on a chuck from which the work can be removed and a shape that no further spinning of the bottom and part of the sides is required. In other words, the lower half of the pitcher is made on a one-piece chuck, and subsequent operations are performed on a sectional chuck. The chief reason for this is that the portion of the work already spun serves to hold together

the various pieces making up the sectional chuck while the job is being completed.

After making the first chuck, turn out a core for the sectional one using steel stock. This core is merely a cylinder. Its diameter should be about $\frac{1}{2}$ in. less than the diameter of the pitcher opening. At one end of the core a shoulder is left, as shown in the diagram on page 70, and in this a $\frac{1}{4}$ in. shoulder is cut to a depth of about $\frac{1}{8}$ in. This shoulder also contains the



Setup to show how the segments are grouped about the core. The partly spun blank, of course, would really be put over the chuck before the adaptor button is pressed in place.

threaded hole used for mounting the chuck on the lathe.

Now obtain a piece of brass or piece of brass rod with one end a length of half to that of the pilcher core, measured from the bottom of the groove, and of a diameter slightly greater than that of the inside of the first helical pitch at the widest part. Drill a hole about $\frac{1}{16}$ in. diameter straightwise through the piece. Saw the rod into longitudinal sections somewhat like slicing a round cake or pie, except that the slicing must be done in a manner that will permit the pieces to be disassembled inward. In other words, the cuts separating the sections of the ring must be made in such manner that as least one side of the last piece will drop down away from the work when the form is to be removed.

Smooth the sawed surfaces of the pieces making them perfectly flat and solder them together in their original places. The desired hole is a little wider or narrower in fit resulting from sawing and soldering the surfaces. Then a chuck may be used in a lathe and bore the center hole so that it will fit the core of the spinning form snuggly, but not too tightly. Now mount it on a mandrel and turn the outside to conform to the inside contour of the pilcher. At the mouth end, turn a flange



How the completed neck of the pilcher is finally spun down around the sectional chuck.

to such dimensions that it will fit inside the groove previously formed around the core. Heat the brass ring to melt the solder, and wipe the surfaces of the sections clean. The sectional chuck is now complete.

Cut the sheet metal blank as usual, and spin it to conform to the first or one-piece chuck. Then mount the sectional chuck on the lathe, place the brass pieces in their proper positions around the core, and hold them with one hand while you (Continued on page 79)

Know what's Under the Hood?

Then you've a conscience about the motor. Here is a tip on operating efficiency by the service manager of a garage in Nebraska:

"It has become a byword along Auto Row that Quaker State is the best oil obtainable. The repair job we recently completed on a 3/4-ton Dodge truck that had never used anything but Quaker State convinced us again. After 30,953 miles, we found the cylinder wear only 0.0023 of an inch, and the main and connecting rod bearings were OK throughout. In 14 years of experience in automobile service work, I have never seen such perfect lubrication. Inasmuch as not a drop of any oil other than Quaker State was used in this motor we must take off our hats to Quaker State as the peer of them all."

Ordinary motor oils average one quart or more of light-end oil per gallon. This portion burns up in high speed, high-compression cylinders after a hundred miles or so... blows away.

Quaker State removes this light-end material at the refinery. It never reaches your motor. Every gallon of it is four quarts motor lubricant, net. Its use is the true economy in motor oils.

Look for the Quaker State sign... you will find it displayed everywhere you go. Most places now supply Quaker State from the patented green-and-white drum—double-sealed at the refinery.

QUAKER STATE MOTOR OILS and Superline Greases

Price now 30c per quart except in several high-freight areas of Rocky Mountain States.

* If you're experienced, write to Quaker State Oil Refining Co., Oil City, Pa.

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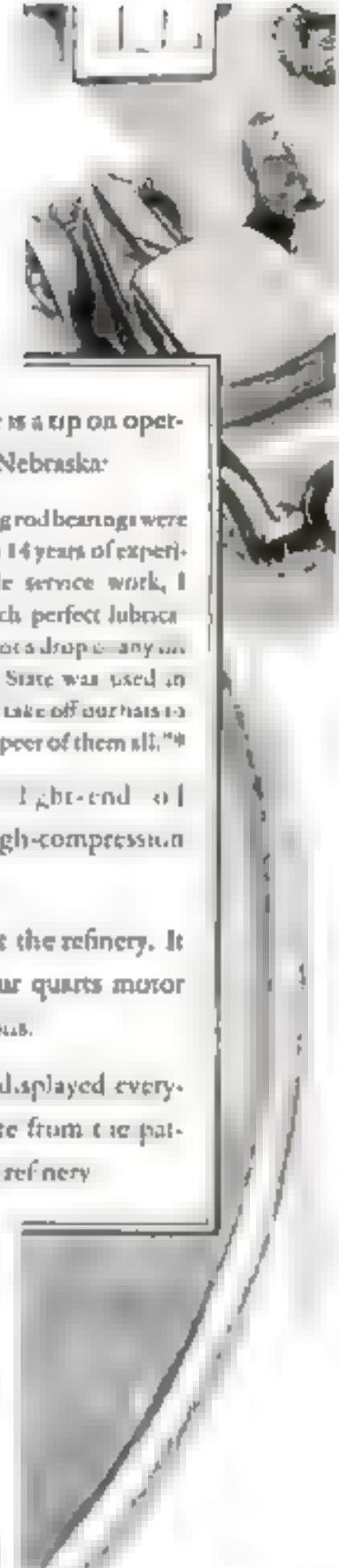


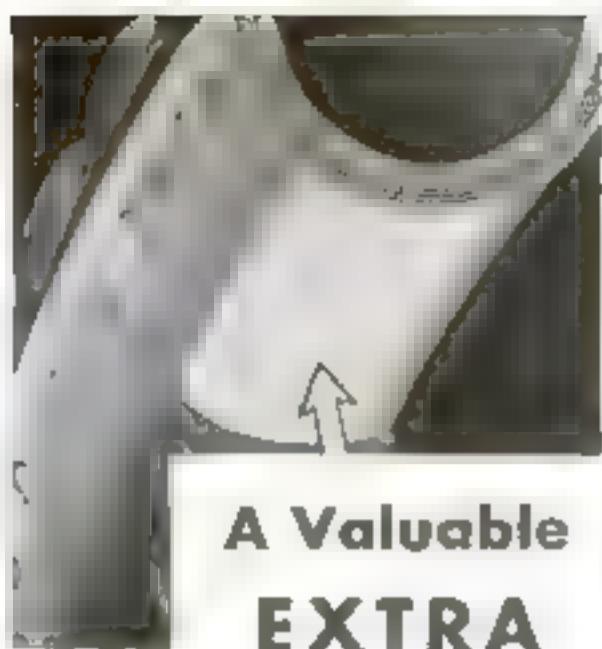
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Please state kind of boat in which you are interested.

THOMPSON BROS. BOAT MFG. CO., INC.
228 Main Street, (also place) Boston 21, MASSACHUSETTS





A Valuable EXTRA

**that Saves your Tires
—and Costs you Nothing**

Even if a tire makes swell marks in the mud it's not much of a tire if it creeps on the rim and pulls valves out by the roots.

In other words, look at the rim side of a tire as well as its tread. On a U. S. Giant Chain Tread (or any other U. S. Tire) you'll find a Flannelette Rim Strip built right into the tire. It's put there to make a better bond with the rim—it prevents creeping—and, with proper rim cement, not shellac, you'll never have trouble with tires that pull loose. The fuzzy rim strip takes hold of more cement—the cement grips the rim—and the tire stays put for keeps. Which is just one of the more-for-your-money features built into U. S. Giant Chains at no extra cost to you.

**Get all four of these features
in the bike tire you buy . . .**

- 1 Construction** . . . three strong plies all the way around (not just 2 plies and a breaker strip) - deep, buttressed tread of toughest crude rubber known.
 - 2 Rim Grip** . . . flannel strip makes possible grip that prevents creeping, eliminates separation of tire from rim. (On all U. S. tires.)
 - 3 Non-skid Tread** . . . specially designed to give greater non-skid safety under all riding conditions.
 - 4 Appearance** . . . sidewalls are permanently white, treads permanently black - tire always new-looking.

**Every one of these features means more miles
less trouble
start for your money!**

**United States
Rubber Company**

World's Largest  Producer
of Rubber

All U.S. fires at
ways have this seal

U.S. Giant Chains

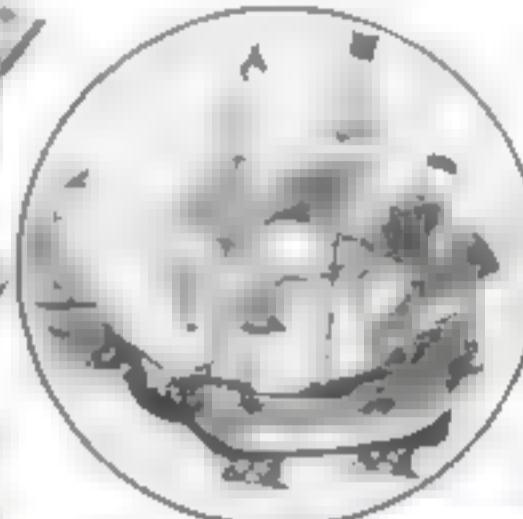
"with the GRIP that never slips"

Our Construction Kits

Will Save Your Time



KIT NO. 14



KIT U



№ 2



KIT 9



KIT A

KIT P-Materials for 18-19 model at Manhattan

- | | |
|--|--------------|
| No. 2. Solid mahogany tray-top table 23
in high with a 15 in. diameter top. Ready
to assemble | 7.25
5.90 |
| No. 3. Tilt-top coffee table in selected
maple with top 19 by 28 in., and 21 in. high.
Ready to assemble | 7.15 |
| No. 4. Solid mahogany book trough 22 1/4
in. long, 9 1/2 in. wide, and 24 1/2 in. high over
all. Ready to assemble | 5.10 |

Popular Science Homecraft Guild
101 Fourth Avenue, New York, N. Y.

There are many ways to do this, but here's one simple way:

וילג

312

City _____ **State** _____ **Zip Code** _____

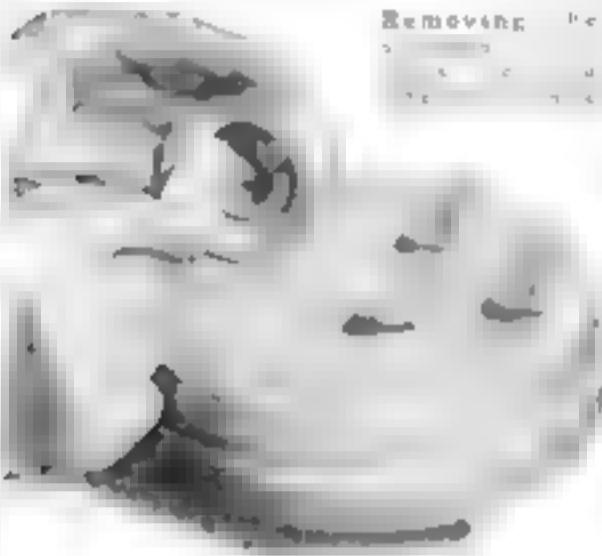
Note. Prices of all kits except # are 30 cents.
The new oil the Mississippi River because of
submarine charaters. We may be per-
mitted to have it and it will be under
the same conditions as the old oil.
It is to be used in the Mississippi River
and the Gulf of Mexico or Part
of the Atlantic Ocean. The oil can
be sold in the United States.

SPINNING METAL WITH SECTIONAL CHUCKS

(Continued from page 77.)

slip the partly spun work over the end. The contour of the right-hand half of the one-piece chuck should coincide exactly with that of the corresponding part of the sectional form, so that the part of the work already spun will hold the sections together tightly.

Run the tailstock bar on against the hot tom of the pitcher and complete the spinning.



Then slide the pitcher and sectional form off the steel core, and you can remove the pieces with your fingers or pliers, since one of them has been designed to slip inward and free the others.

In spinning the pitcher, or rather in making the forms, allow for enough projection to form the lip. Trim the top to its final shape with tin snips and finish by filing the edges smooth. When several pitchers are to be made, prepare a template for marking the top edges. Make a handle of heavy wire or flat stock and solder or rivet it in place.

In a similar manner, the sugar bowl illustrated on page 76, with its lid of matching design, may be made.

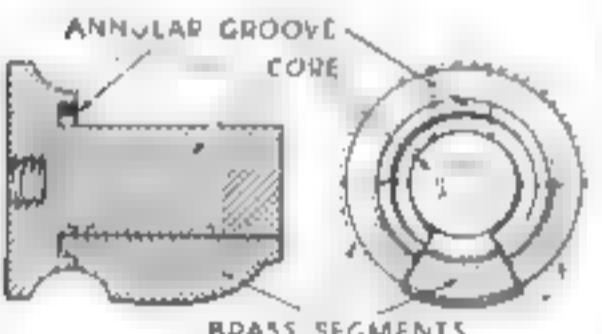


Diagram of the chuck. One segment, the key piece, is designed to drop inward.

The pitcher and bowl will give years of service if chromium plated. Doubtless an enterprising spinner could find a market for several dozen sets at a price of a dollar or two a set.

This is the fourth of a series of articles that began in the March issue. The fifth article will explain other spinning jobs.

TRAINING VINES OVER A CONCRETE WALL

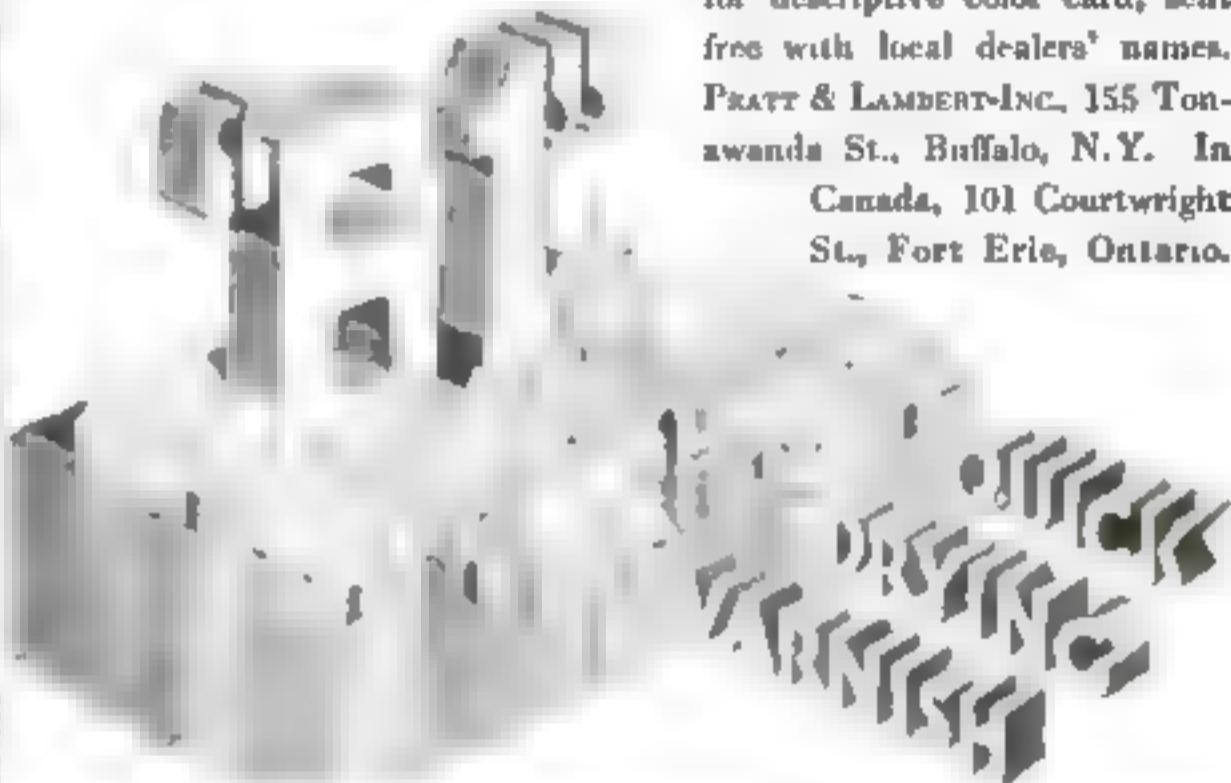
If you have ever tried to drive a nail into a concrete surface to train climbing roses or other plants, you know how difficult it is to do. Instead of nails, use the heavier grade of phonograph needles, which can be bought for ten cents a hundred. Hold them while being driven by pushing them through the end of a short piece of leather shoe lace or something similar.—R. G. Brown.

acres of floors from coast to coast, retain their lustrous beauty for years, without rubbing or polishing, because they are finished with "61" Quick Drying Varnish—the floor finish that eliminates drudgery. Constant renewal is not necessary. No care is required except the use of a dry cloth or mop for cleaning. You can wash it with soap and water if you wish. "61" QDV floors are safe—no danger of slipping or injury. "61" QDV renews and brightens linoleum, furniture and woodwork. It is heelproof, marproof and waterproof. Sold by paint and hardware stores in glistening Clear Gloss, the popular Dull Finish and four rich woodstain colors. Write

for descriptive color card; sent free with local dealers' names.

PRATT & LAMBERT INC., 155 Tonawanda St., Buffalo, N.Y. In

Canada, 101 Courtwright St., Fort Erie, Ontario.



Lasting results at lowest cost on other painting work, "61" Floor Enamel for solid-colored floors; "61" Quick Drying Enamel for furniture and woodwork, "61" Quick Drying SEMI-Varnish for all marine and exterior work, each guaranteed to give complete satisfaction.

PRATT & LAMBERT VARNISH PRODUCTS

\$2.00 WOOD TURNING LATHE



WHAT CAN YOU DO WITH ONE INCH?

The 1-inch engine will fit into almost any space. It can be mounted on a wall, in a window, in a closet, in a shell, etc. The world of new or better products produced by the 1-inch engine is almost boundless. Just a few examples of what can be done with one inch of engine power:

1. Make a 1000-watt electric heater.

2. Make a 100-watt electric fan.

3. Make a 100-watt electric lamp.

4. Make a 100-watt electric motor.

5. Make a 100-watt electric pump.

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123. Make a 100-watt electric heater.</p

NEW!

RCA Victor's AUTO RADIO

*installed in
30 minutes*

ONLY \$34⁹⁵

Slightly higher in Canada and west of Rockies

DEMAND four things from an automobile radio. First, compactness. Second, easy installation. Third, tone and performance. And fourth, a fair price.

RCA Victor offers an automobile radio which has all this—and more. It is in a single unit . . . you can install it in 30 minutes, only two simple electrical connections, no soldering, and only one hole to drill . . . It has the tone and quality that RCA Victor alone can build into a radio . . . and the price is so low that everyone can enjoy a radio in his car—just \$34.95.

The new RCA Victor Auto Radio also has Tone Control, a full electro-dynamic speaker and a tube-less "B" battery eliminator. There's no better buy at any price . . . It's top in quality, yet bottom in price.

On sale at any
RCA Victor dealers and many auto
accessory shops



"THIS IS MISTER X'S VOICE"
—On the Road

RCA Victor

Company, Inc.

A Radio Corporation of
America Subsidiary

Camden, New Jersey



HOME WORKSHOP BLUEPRINTS

New projects are marked with an asterisk (*)

TO ASSIST you in your home workshop, POPULAR SCIENCE MONTHLY offers large blueprints containing working drawings of a number of well-tested projects. The blueprints are 15 by 22 in., and are sold for 25 cents a single sheet (except in a few special cases). Order by number. The numbers are given in italic type and follow the titles. When two or more numbers follow one title, it means

that there are two or more blueprints in the complete set. If the letter "R" follows a number it indicates that the blueprint or set of blueprints is accompanied by a special reprint of the instructions originally published in the magazine. If you do not wish this reprint, omit the letter "R" from your order and deduct 25 cents from the price given. Reprints alone are sold for 25 cents each.

Flying Airplane Models

Bremen-Junkers	3-11	25-30	2
Lindberg's Monoplane	3-11	25	
Nieuport XVII	20-in.	100-140	50
Rise-off Ground Tractor	3-4L	50	35
Seaplane Tractor	20-in.	67	25
Scrap Iron Morris (Record 12½ min.)	102		5
E to Ward Well Plant	10-in.	168-248	50
Single-Blade Tractor	20-in.	82	25
Tractor (Record Flight 6.024 ft.)	104		25
Two-Pusher Racing	3-in.	86	
Winnie Mae	4-in.	141-142-143	75

Boats

Canoes, Sailing Outfit	25	25	
Canoes, 16-ft. Canvas-Covered Kayak with Sail, etc.	192-193-194 R	100	
With full-size patterns	250		
Duck Boat, Folding	210 R	50	
With full-size patterns	200		
Outboard Motor 10½ ft.	56-16 128-129 R	5	
With full-size patterns	229		
Outboard Race 10 ft. 4 in.	14-16 211-212	50	
With full-size patterns	200		
Pat-boat Motorboat Combination 12 ft. cat rig	116-122-123 R	100	
With full-size patterns	250		
Mercury R-2 with J-2 for Above	125A	75	
12-ft. Rowboat Motorboat	147 R	50	
With full-size patterns	200		
14½ ft. Rowboat Motorboat	148 R	50	
With full-size patterns	200		
16-ft. Rowboat Motorboat	149 R	50	
With full-size patterns	200		
Stern Drive Intra-Loket. When used with Rowboat Motorboat	150	25	
25½ ft. Runabout or "Sportboat" (outboard or inboard motor)	175-176-177 R	100	
With full-size patterns	250		

Furniture

Bookcase, Simple	21	21	
Buckethand Book Ends, Modernistic	100		
Bookshelf, Hanging	1	1	
Bookstand, Modernistic	48		
Buck Trough	68	25	
Cedar Chest, Mahogany Trimmed	17	25	
Chair, Rush Bottom	34	25	
Chest, Treasure	78	25	
Clock, Grandfather	19	25	
Desk, Colonial	21	25	
End Table, Magazine	65	25	
Fireside Beach, Colonial	187A-188A	20	
Kitchen Table Cabinet	27	25	
Lamps, Modernistic	93	25	
Mirror, Scroll Frame	105	25	
Motion Stand, Padding	174A-174B	25	
Pet Cabinet and Corner Shredder	77	25	
Radio Cabinet Console	87	25	
Screens, Modernistic, Folding	72	25	
Sewing Cabinets, Two, Jr.	73	25	
Sheets and Lamp, Modernistic	93	25	
Smoking Cabinet	2	25	
Stand, Low Modernistic	100	25	
Table, Gate Leg	24	25	
Table, Tavern	705	25	
Table, Tilt-Top, Oak (Top 20 by 24 in.)	140	25	
Tea Wagon	27	25	

Radio Sets

Amplifier, Three-Stage, Audio-Frequency	42	25	
P.A. Electric Headphone Set	100	25	
One-Tube Battery Operated	107	25	
Screen Grid Set	109	25	
Short-Wave Converter Unit	137	25	
Amateur Short Wave Receiver	155	25	
Amateur Radio Transmitter	183-184	50	

Ship and Coach Models

Bark, Beagle Half-Model (13½-in.), 104	.25		
Battleship—U. S. S. Texas (5 ft. Hull)	197-198-199-200	1.00	
See page 78 for list of materials			
Battle, Clipper Ship, 12x-22	80		
Clipper Ship, 8-in. Hull	51-57-53 R	.00	
Constitution, 2-in. Hull	57-58-59 R	.00	
Covered Wagon	23½-in. h	1.1-1.2-1.3 R	.00
Destroyer—U. S. S. Preston (31-in. Hull)	125-126-127 R	1.00	
See page 78 for list of materials			
Galleon, Spanish Treasure	24-in. l	.45-47	.10
See page 78 for list of materials			
Mayflower (17½-in. Hull)	.83-84-85 R	1.00	
Minature Coach and Covered Wagon for Decorating Boxes, etc.	202 R	.30	
Motorboat, 20-in. Cruiser	.83-84-R...	.75	
Motorboat, Working Scale Model Driven by Rubber Bands or Toy Outboard Motor (20-in. Hull), 196			.25
Liner—Manhattan (12-in. long)	204		
See page 78 for list of materials			
Purple Galley or Felucca	20-in.	.44-45 R	.75
Roman Galley	19-in.	138-139 R	.75
Rowboat—Square and Port-and-Ait for Wherry Wanderer or any Model	183-184	.50	
Santa Maria (10-in. Hull)	74-75-76 R	1.00	
Schooner—Blue Nose (17½-in. Hull)	110-111-112 R	1.00	
Bedan Chair, Queen's	12-in.	123-124	.75
Stagecoach, Concord (20-in. in.), 115-116	117 R	1.00	
Stagecoach, Cody with Horses (Coach Body 12-in. Long)	146-147-148 R	1.00	
Steamboat, 30-in. length	191, n	.84-85-86 R	.00
Viking Ship	70-in.	.81-82 R	.75
Whaler Vane Ship Model	10-in.	.44	.25
Whaler—Wanderer	20½-in.	.44 to .46	1.00
See page 78 for list of materials			
Yacht Sea Scout	42-in. Rafting	.108-109 R	.75
Yacht	70-in. Racing	48 R	.50

Toys

Airplane Cockpit with Controls	114	.25	
Bear and Ant Man, Jig Sawed	58	.25	
Do It House, Colonial	72	.25	
Drill Press, Lethe Saw, etc.	113	.25	
Dump Truck Fire Engine, etc.	101	.25	

Miscellaneous

Log Cabin Three Rooms	174-R	.50	
Puzzles, 12x8-in. Block	65	.25	
Tool Cabinet, Bench Hook, etc.	30	.25	
Workbench	15	.25	

Popular Science Monthly
301 Fourth Avenue, New York

Send me the blueprint, or blueprints, numbered as follows:

No.	No.	No.	No.
No.	No.	No.	No.

Patterns for

Reprints alone for . . .

I am inclosing dollars cents.

Name

Street

City and State

Note: Please print your name and address very clearly. If you do not wish to cut this page, order on a separate sheet.

MASTS AND YARDS FOR THE REVENGE

(Continued from page 62.)

can be painted white and red. Glue them down neatly and securely on the cross-trees.

In the bottoms of each top are cut a hole for the masthead, another for the heel of the topmast, and a long slot each side to pass the rigging through. At the edges are drilled holes for the extensions of the topmast rigging.

At the mastheads are the caps, to restrain the topmasts. They can be made of $\frac{1}{2}$ -in. fiber board, celluloid, or hardwood. They have the following holes: a round one for

KEY TO RIGGING

To save space the following abbreviations are used:

bowsay	mainmains	Mrs.	mizzen
Bv	mainmains	shds.	shrouds
F	fore	spcl.	spars
ftd.	fore yards	T	top
L	lower	T5	topall
M	main	Tt.	topgallant

The cord and block sizes are indicated by the small letters following the name of the line. Cord $\frac{1}{2}$ in. is equivalent to No. 18 (B. & S.) gauge wire. A No. 2 $\frac{1}{2}$ in. rope to No. 30 wire. Blocks $\frac{1}{2}$ in. are 3 ft. 16 in., 1 ft. 1 $\frac{1}{2}$ in.

1 F mast	49 F crew line
2 M mast	50 M crew line
3 M g. masts	51 M sheet bld
4 Bv mast	52 M sheet sld
5 B bowsay	53 F bowsay
6 Bonaventure	54 M bowsay
7 F T stay a	55 F bowsay
8 M T stay a	56 M bowsay
9 M T stay a	57 F TS ad
10 B T stay a	58 M TS yard
11 F fore ST hull	59 F topmast
12 M T stay a	60 M topmast
13 F T shrouds a	61 F TS clew
14 M T shrouds a	62 M TS clew
15 M T shrouds a	63 F TS bowline c
16 M T shrouds a	64 M TS bowline c
17 L M T stays a	65 F TS ha. b. d
18 Miz. and Bv. cross-trees	66 M TS ha. b. d
19 F and M tops	67 F TS sheets b
20 Miz. and Bv. tops	68 M TS sheets b
21 P T mast	69 F T. ad
22 M T mast	70 M TG yard
23 Miz. T mast	71 F TG sail
24 Bv T mast	72 F TG ad
25 F and M caps	73 F TG bowlines c
26 Miz. and Bv. caps	74 M TG bowlines c
27 Miz. M T mast	75 M TG ha. b. c
28 Miz. M T mast	76 M TG ha. b. c
29 M T mast stay a	77 M TG sheets c
30 M T mast stay a	78 M TG sheet c
31 Miz. T mast stay b	79 Miz. yard s. r.m.
32 Bv T mast stay b	80 Bv yard (latrine)
33 F T mast stays	81 Miz. sail
34 M T mast stays b	82 W
35 Miz. T mast shrouds b	83 Miz. tack b
36 Bv T mast shrouds b	84 Bv tack b
37 T mast shrouds b	85 Miz. sheet b
38 M T mast shrouds b	86 Bv sheet b. a
39 F TG mast	87 Miz. shrouds
40 M TG mast	88 Miz. shrouds
41 F T. stay b	89 F TG braces b. d
42 M T. stay b	90 M TG braces b. d
43 F TG shds. b	91 F TG braces b. e
44 M TG shds. b	92 M TG braces b. e
45 F yard	93 M TG braces c. f
46 M yard	94 M TG braces c. f
47 F sail	95 M TG braces c. f
48 M sail	96 Seal. brace lifts b. a

Note: Parts 17 to 20 are put on the masts before the masts are erected.

Tear This Out!

Mail it Today

GOOD FOR FREE PACKAGE

THE CASEIN MFG. CO. OF AMERICA, INC.
207 East 42nd Street, New York, N.Y.

Please send me, absolutely free, a sample
of CASCO Waterproof GLUE.

Name _____
Street _____
City _____ State _____

and
receive

FREE SAMPLE CASCO WATERPROOF GLUE

It will work wonders for you as it has for thousands of other Popular Science readers. Things that would not stay glued before...now you can put them together **permanently**, in spite of moisture, heat, rough usage or plain neglect.

New Easy Method of Building and Repairing Things

Home craftsmen and amateur mechanics everywhere are discovering how CASCO Waterproof Glue, the wonder-working adhesive, makes it possible to glue things easily, quickly and **permanently**, just as is done in big woodworking and furniture factories.

And they are amazed and intrigued to find that CASCO...a clean, non-odorous powder...mixes so quickly in cold water, forming a creamy, easy-spreading glue, makes all jobs **permanent, heat-proof and moisture-proof**.

Unlike ordinary glues and pastes which harden merely through evaporation, CASCO SETS CHEMICALLY LIKE CONCRETE. Articles glued with CASCO stay glued.

CONVINCE YOURSELF

Take your free sample and prove CASCO's quality. The free sample you receive will cover enough CASCO to do a test job and prove CASCO's superiority. In larger quantities CASCO may be obtained from your Hardware, Paint or Building Supply Dealer. 1 lb. can 40¢; 1 lb. can 63¢; also 3 lb. and 10 lb. moisture proof bags.



CASCO is Economical... 1 pound of CASCO makes 1½ quarts of Liquid Glue!

THE CASEIN MFG. CO. OF AMERICA, INC.
207 East 42nd St. New York, N.Y.

THE WORLD'S LEADING .22 AUTOLADING RIFLE...

Remington

**Model
24**

With a .22 Remington Model 24 you can make shooting targets or hunting game and game that you never thought possible. It's so fast that you don't give it away more shot than with the ordinary repeating rifle.

A film shows you how to shoot your aim and you just keep pulling the trigger till you connect.

(Beautifully finished; as well built and dependability in operation; simple in construction, and accurate as only Remington can make them. See the Model 24 at your dealer's and write us for descriptive circulars. Remington Arms Company, Ilion, New York, Conn.)

ALWAYS SHOOT

K *Remington*
KLEANBORE
.22 CARTRIDGES



B. If you're working and don't have time to go to the store, we'll mail you a Kleanbore. Complete with instructions, it will be ready to use in just a few minutes.

P.R. At F.I.C.A. 100% tax-free.

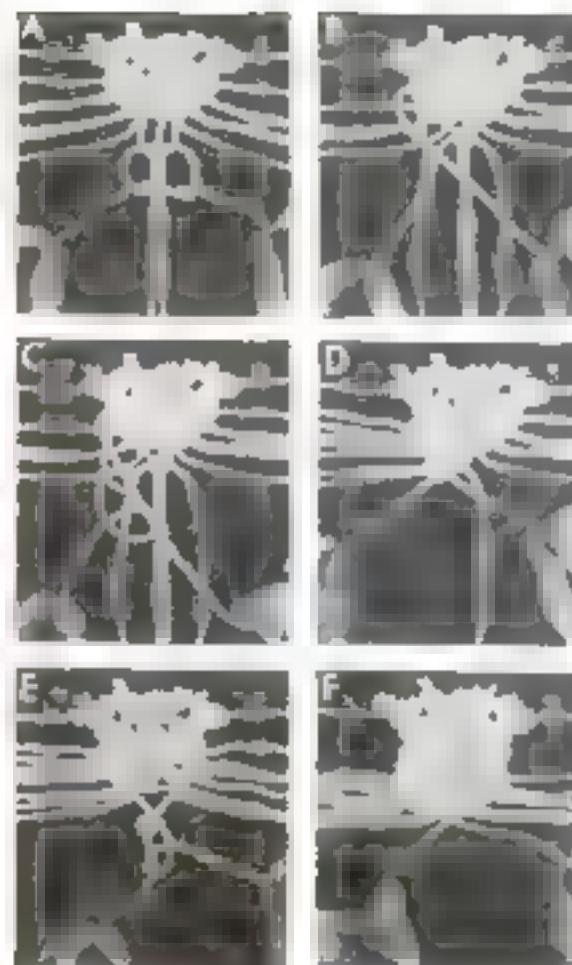
Also: information on how to buy Kleanbore. Mail us a self-addressed envelope and we'll mail you a copy.

We carry stock supplies and machines for the production of Kleanbore. We can supply you with all materials if you want to make your own. We also supply plywood brace discs for use in making Kleanbore.

Mail us a self-addressed envelope and we'll mail you a copy.

FREE CATALOG

H. H. Remington & Co., 73 Remington Ave., Ilion, N.Y.



Six steps in forming a strong, well-pointed end on any wide piece of square-knot work.

POINTING OFF THE ENDS OF SQUARE-KNOT WORK

THOSE who have taken up the hobby of knot work and are making belts, ties and various nautical projects will find the method illustrated above an excellent one for finishing off any square-knot article with a pointed end.

Form the point first by dropping two strands at the side of each row of knots as shown at (A). Then bring the top strand in one step down to the point (B) and turn a double half hitch around it with the second strand as at (C). Drop the top strand again in the same manner, bringing the remaining strands around the last knot to make a new starting at the point (D). Do the same with the other side and half hitch the tail or tail, coming together at (E). When the three main half hitches are completed at (F) the end of the article is finished.

This is the method used for finishing the square-knot tie described in a previous issue of P.S.M., Apr. '35 p. 10, and it can be applied frequently to this kind of work.

For other knot work articles see P.S.M., Nov. '32, p. 77; Mar. '33, p. 68; May '33, p. 68.

CONDENSERS YIELD FOIL FOR MODEL MAKING

The next time you need very thin metal for model making or other purposes, pay a visit to some radio experimenter. He will probably have in his junk box a defunct paper tape filter condenser. These condensers are made up of alternate windings of wax paper and aluminum foil. The foil is about .001 in. thick and from 4 to 5 in. wide. Getting at the foil is not as hard as it looks. Hang the condenser in the air in a tin can and place the can on a radiator or stove where there is a steady, even heat so that the wax and pitch covering will melt. When the condenser is again cool enough to handle start unwinding the paper and foil. Do this very carefully as the foil tears easily. Do not strip up the foil immediately but leave it stretched out on the floor so that if there is any wax left, it will be dry before the foil is rewound.—H.S.

PLANKING AND FINISHING OUR NEW RACER

See article front page 13.

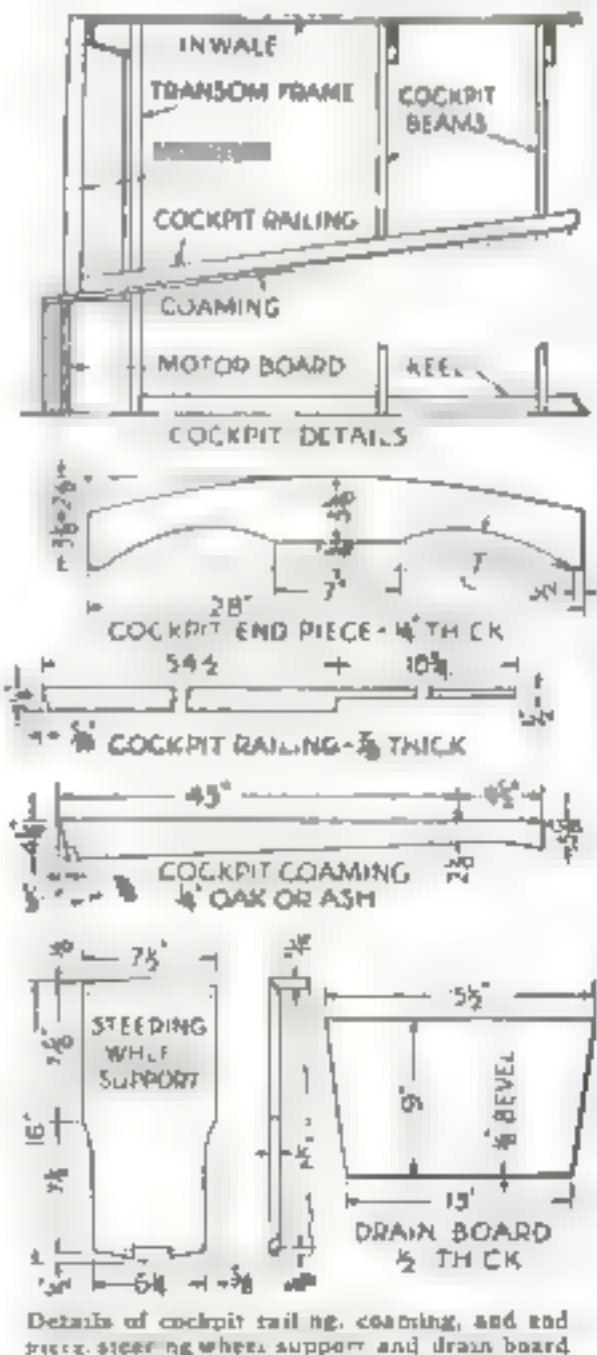
drip board and transom back is now sawn out, fitted carefully in place, and fastened to the coaming with three 1 in. No. 6 screws to each side. The lower end is fastened to the motor board with three 2½ in. No. 8 screws, driven through from the outside. Holes $\frac{1}{8}$ in. in diameter are drilled through the transom and motor board at each corner of the drip board, and $\frac{1}{4}$ in. support tubes inserted. Water and gasoline drippings may then flow free overboard. If desired the drip board may be lined with sheet copper.

Attaching the steering wheel and the plywood flooring is the final job. Fasten the floor and the floor to the frames with 1 in. No. 6 screws. The lower end of the wheel support is beveled and notched out for the leg, while the upper end is properly beveled to fit against the cockpit end piece and secured with three 1 in. No. 8 screws.

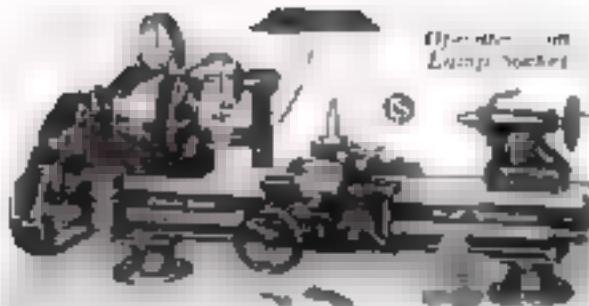
The floor molding is attached with 1-in. No. 6 screws spaced every 6 in. The ends of the planking at the stern are planed square, and a small end piece is fastened with one 1 in. No. 6 screw.

The hull is now varnished or painted according to one's preference. To have a really smooth running finish on the bottom three coats of hard racing bottom finish should be applied. Allow sufficient time for each coat to dry, and rub each down with pumice stone. When the final coat has been thoroughly rubbed down, apply a high-grade furniture or automobile wax to paste form and polish it well.

The installation of the steering wheel, tiller control, and the completed the hull.



Details of cockpit railing, coaming, and end piece; steering wheel support and drain board.



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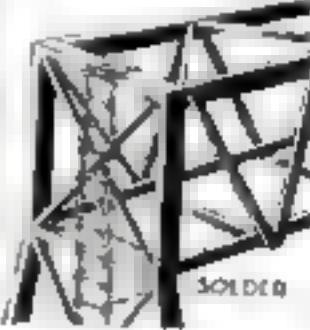
SMALL MODEL LADDERS MADE FROM CHAIN

ALTHOUGH the accompanying photograph seems to show a piece of brass "ladder" chain sticking up in the air in defiance of the laws of gravitation, it is not a lesson in magic at a model of the Hindu rope trick. The action of chain that sticks up from the fingers does so because solder has been flowed into the joints of that portion of it while it was tightly stretched between two boards.

Building miniature ladders for model rail way signal bridges or semaphores from separate pieces of wire is a tiresome process. Often a piece of chain soldered along the edges in this way will serve the purpose just as well. The best type of chain, because of its straight, thin,

square links and neat joints, is that found in boy's mechanical construction sets and used for motor drives. This chain will give an effect when set in place like that illustrated in the drawing.

J. G. Makivic



Don't Monkey with an Oilstoned edge

This foreman in the rubber factory dared me to touch the edge of his knife, but I begged off. "These short, stout knives we use on warping rolls to trim off the overhanging rubber as it comes along are *oilstoned* so sharp that you can't fool with them."

Worn rubber is tough and clinging, so the blades are lubricated with water. As the oil-stoned person will have the knife jerked out of his hand if he doesn't keep the edge straight and firm against the stream of rubber.

"Expert workmen," this man said, "all finish an edge of a tool on an *oilstone*. For ordinary coarse textured materials, whetting may do. The test is to work one day with an *oilstoned* edge. Note the greater quantity of work done, the quality of work and how much less tired and strained you are."

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JIG-SAW PUZZLE SHORT CUTS

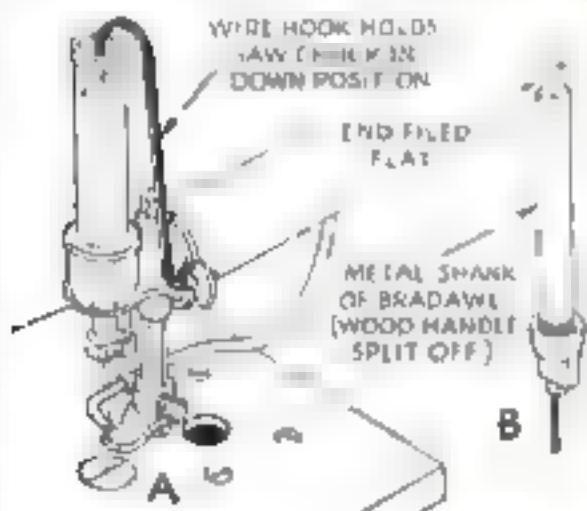
(Continued from page 61)

puzzle saw or by planing. In the latter case, lay the panel flat and face up on the bench allowing it to extend several inches beyond the edge. Standing at left end of bench, hold the panel down firmly and against bench stop or vise with left forearm, and trim the edge with a sharp block plane held in right hand and drawn toward you. The blade must be set for a shallow cut. It will raise the edge of the picture, but remove this bur later with downward strokes of a sharp file held vertically. Instead, the edges are trimmed with the same blade which is used to saw the puzzle; they will show the same treatment as the other cuts, thus making the puzzle more difficult to assemble. Keep the trimmed panel face down under weights until ready to saw.

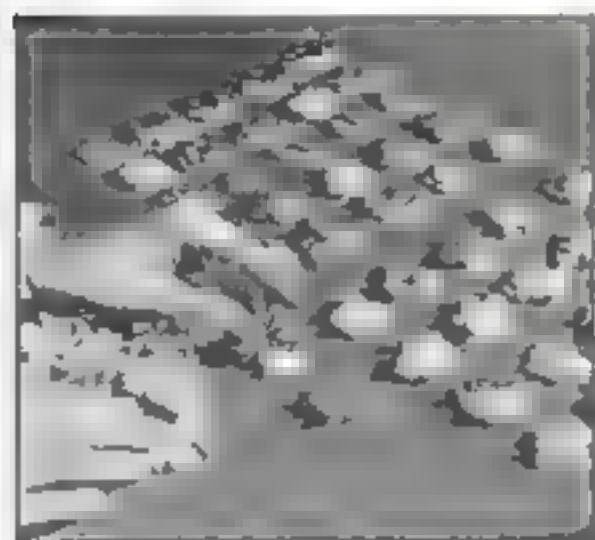
A flat varnish is sometimes applied, but is not advisable. Panels so treated are harder to saw, and it serves no real purpose.

Figure Pieces. These make puzzles less difficult, though more interesting to many fans. If not well done, they are better eliminated. When but a few are needed, a master copy should be drawn and carbon copies made on thin bond paper. If used in quantities, draw full sheets of patterns through hectograph carbon paper or with hectograph pencil and reproduce 50 or 75 copies with a cheap hectograph outfit.

Patterns may also be drawn or traced on the back of the panel and the puzzle sawed face down with the saw blade reversed.



An aid in cutting saws and an extension chuck



Pieces are counted by laying them in piles of two with twenty-five piles to each group



The assembled puzzle is turned face down, held tightly with clamps of the same thickness, and then sanded until smooth.

This is a slow process and the picture receives needless wear and tear from contact with the saw table.

Determine the patterns to be used on a single panel. Clip these and use rubber cement to fasten them on the face of the mounted picture. Remove surplus cement from the picture by rubbing circularly with the heel of your hand.

Sawing. The choice of blade is largely a personal matter. Try them at various speeds for different results. Pulleys may be built up with gummed paper tape. My choice of saw blade is one that is .007 in. thick, .026 in. wide, and has 21 teeth per inch. There is a trick in operating this blade that makes it possible to cut figure pieces with facility. When a sharp corner or point is desired, turn the panel quickly, then stop for a moment. The blade will flip around and may be lined up in the new direction before continuing.

After the figure piece has been sawed, the pattern may be peeled off with tweezers or a pocketknife. Rub off any remaining rubber cement with a small ball of the same material, which may be collected by rolling the cement from the cardboard upon which you had the patterns while spreading cement on them. Should a pattern stick or the picture surface

(Continued on page 66)



Two frames covered with insect screening and hinged together are used in cleaning the puzzle pieces, which are placed between them so the dust can be quickly blown or sucked out.



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JIG-SAW SHORT CUTS

(Continued from page 56)

square then contains fifty pieces. Minor repairs may be made during this operation before boxing the puzzles.

Boxes. Make your own as described elsewhere in this issue or obtain empty cardboard boxes from any haberdashery. If none is available of the proper size, cut down larger boxes, reinforce with gummed paper tape or paper strips, and cover with colored paper or wall or shell paper. All boxes should be uniform in style and color scheme. Choose a trade name and have neat, colorful labels printed.

Keep a record card for every puzzle you make and list all data such as title, date, size, number of pieces, cost, selling price, or rental schedule. My own method of renting them is to base the weekly charge upon 10 percent of the retail value of the puzzle. Thus, if the puzzle is worth \$5, the rental with one week's time limit is 50 cents, and the overtime charge is 10 cents.

Lod Pierces. These are the bane of every puzzle owner. Obtain the pieces which surround the hole and fasten them together in the correct position with gummed paper tape attached to their bottoms. Lay on a smooth surface and place a sheet of thin, white paper over the hole. Rub with a flat, smooth piece of lead. This gives an outline of the edge of the hole. Prepare a scrap of plywood by gluing a piece of good bond paper to one side. Attach the pattern to this surface with ruler cement and saw with a slow, accurate cutting saw. Then remove the pattern and paint the paper surface to match the surrounding area, using water colors or oils. After it is thoroughly dry, coat the surface thinly with flat varnish.

Finally, remember to give Uncle Sam 10 percent of the selling price of every puzzle.

Prizes for Best Family Group Photos

FROM the many excellent family group photographs submitted in the fourth of our \$100 photo contests (P. S. M., Feb. 13, p. 74), the following were chosen as the best in respect to photographic qualities, general arrangement, lighting, and naturalness of pose:

FIRST PRIZE, \$50
L. DeS. Dibert, Philadelphia, Pa.

SECOND PRIZE, \$35
Moe Simon, Paramus, N. J.

THIRD PRIZE, \$10
Cable Wagner, Shreveport, Okla.

FOURTH PRIZE, \$5
J. P. Keeps, DeForest, Wis.

FIFTH PRIZE, \$5
R. Marion Shields, Danville, Ky.

SIXTH PRIZE, \$5

Henry N. Etelson, Jamestown, N. Y.
HONORABLE MENTION—Paul R. Bergman, Spokane, Wash.; William L. Falk, New York, N. Y.; Alan Lee Fornier, Berea, Ky.; A. L. Marcella, Newark, N. J.; Robert T. Godley, Merriam, Mass.; Mrs. W. E. Miller, Cadillac, Mich.; Mrs. Ernest C. Nagamine, Lahaina, Maui, Hawaii; Oliver P. Pearson, Phila. & Sons, Pa.; A. Remmert, Hinsdale Heights, N. J.; Ray Seaver, Portland, Ore.; Mrs. H. B. Schell, Somerville, N. J.; Jean L. Taylor, Chicago, Ill.

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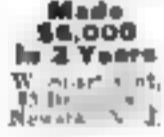
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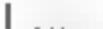
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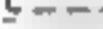
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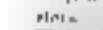
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THATCHED ROOF COVERS BIRD HOUSE

HEKE is a bird house that birds like. During its first season two sets of bluebirds were hatched in the original house shown in the photograph.

The only piece of lumber required is a 5-ft length of one-by-four. Everything else can be picked up. The thatching for the roof and the strips of bark which are used to finish the sides may be gathered along almost any roadside woods or stream. Broomsticks are easy to obtain, and any hardware store has empty nail kegs. An empty fruit box from the corner grocery, a short length of old clothesline, and a 2-ft strip of roofing tape (ready roofing) complete the lot of materials. Scraps of sheet metal or thin strips of wood that will bend readily (such as fruit box sides) might be substituted for the roofing paper if the latter is not readily available.

Dried cat-tail leaves make good thatching (few straw is the old-time favorite), but gather plenty of them as they shrivel rapidly. Hickory bark is excellent for the sides, but any durable bark will do. Although adding to the attractiveness, the bark and thatching are used also to protect the interior from extremes of temperature.

This bird house is of the hanging type which is preferred by many birds because it offers security from cats and other natural enemies. It is made in two sections to facilitate cleaning at the end of the nesting season.

For the lower portion, cut a nail keg in half. At the center of the bottom bore a 1-in hole to receive the end of the broomstick. Also bore a dozen or so $\frac{1}{4}$ -in. holes in the bottom for ventilation and drainage. Now tack strips of bark to the outside, allowing the rough and jagged ends to extend several inches below the bottom as shown.

For bluebirds, bore three $1\frac{1}{2}$ -in. holes in the sides, locating them $4\frac{1}{2}$ in. from the bottom of the keg—one each facing east, west, and south. More than one pair of bluebirds may not be expected to occupy a house



This well insulated, attractive but inexpensive bird house was designed by an architect

of the keg. To the lid nail rafters made from the 1 by 4 in. lumber, the rafters, in turn are nailed to the broomstick, which should be about 3 ft. long. The rafters are cut on a bevel to fit against it as shown, and at the foot they are cut horizontally to fit snug against the lid.

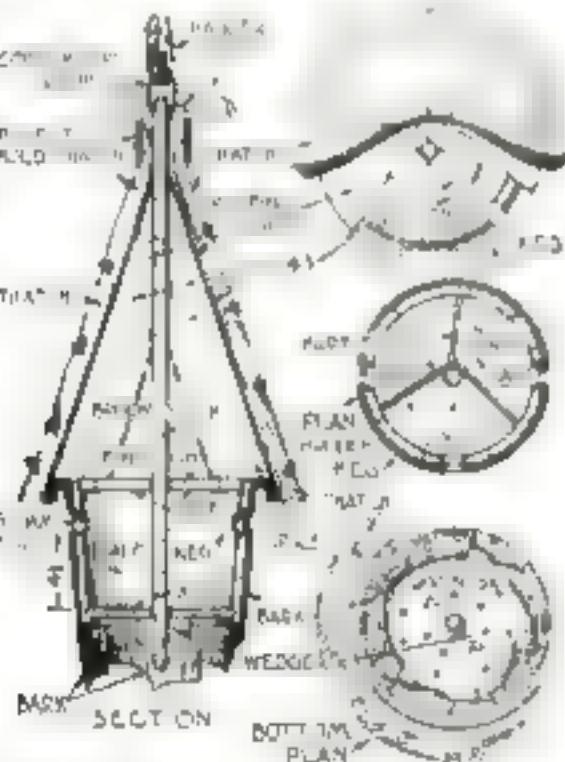
Fasten the roofing paper to the rafters to form a cone-shaped foundation for the thatching. Apply the thatching so that it will be 1 in. or more in thickness, and hold it in place by wrapping it with the clothesline. If necessary, the rope may be prevented from shifting by tacking it to the rafters through the thatch and paper roofing. Bore a small hole near the top of the broomstick to receive a wire loop for affixing the hanger rope.

Finally, assemble the two portions by means of a wedge-shaped pin passing through a slot cut near the lower end of the broomstick. The slot may be easily made by boring two $\frac{1}{4}$ -in. holes $1\frac{1}{2}$ in. apart and, with knife or chisel, removing the wood between them.

If it is desired to attract wrens instead of bluebirds, make the entrance holes only $\frac{3}{4}$ in. in diameter. And, if desired, provide more compartments by fitting in another floor, thus making a two-story house. In the latter case, use about two thirds of a keg instead of one half.—JAMES THOMAS

ADAPTER MAKES FUNNEL FIT BOTTLE BETTER

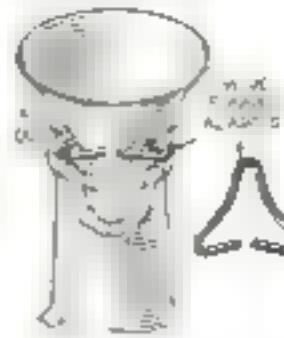
SOMETIMES it is necessary to fill a bottle by means of a funnel that is too small for the neck. This can be remedied by bending a piece of stiff wire to the shape shown and sliding it on the spout of the funnel. It holds the funnel in an upright position even though the neck of the bottle is much larger than the spout. At the same time, it lets the air escape from the bottle, and this would not be the case if the funnel were allowed to slide into the bottle as far as it would go.—HENRY J. FRASER



How the bird house is constructed. It can be opened for cleaning by taking out the wedge

at the same time, but each pair will raise two successive broods in the same house if fresh nesting compartments are available. The three nesting compartments are equally divided, as shown in the plan view, by means of partitions made from fruit box sides.

Now for the upper section. The fixed lid, as shown in the sectional drawing, is a disk sawed from an end of the fruit box so that it fits the inside of the keg loosely. Bore the lid to correspond with the holes in the bottom



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Grinding a Mowing Machine Sickle

By L. M. ROEHL

New York State College of Agriculture

ONE of the recurrent jobs during the busy mowing season on farms is that of grinding and repairing the mowing machine sickles. Usually two men are needed to do the grinding with a grindstone—one to turn the stone and the other to hold the sickle



Fig. 1. Sharpening a mowing machine sickle on a motor driven grinder designed for farm use.

In such a place where electric current is available the motor driven grinder has advantages over the grindstone and one man can do it in less than half the time required with a grindstone.

A grinder that has the grinding wheels at both ends of the motor shaft is not suited for this and other farm grinding. The motor interferes with holding the sickle and other work to the wheels. The machine shown in Fig. 1 is especially designed as an amateur farm grinder. The motor is back and down where it is out of the way and the power is transmitted with an endless V-belt.

For sickle grinding, the regular grinding wheel which is 6 by 6 in. and on the left end of the shaft is removed, and the beveled sickle grinding wheel is placed on the right end of the shaft.

The sickle is held firmly in both hands on the wheel so that the right side of one section and the left side of the one next adjoining are ground at the same time. It is held on the stone high and moved back and forth. Holding it lightly prevents heating the section excessively. The sparks from the grinder will indicate when the grinding is being done. A sickle needs to be worked on probably just enough on the stone to grind down where the sections meet. It should not be driven down so far as to grind it round off the top of the sections. The grinding is continued until the sections are brought to



Fig. 2. Removing a section from a sickle bar by heating the rivet with a blowtorch and a chisel.

an edge. The wire edge may be removed with an oilstone, but it is not serious if not so removed as it will disappear when the sickle is put into service.

A long sickle is too heavy to hold while grinding near an end. The weight may be carried on a stand placed under it or by a rope sling hanging from above.

By this method, a 6-ft sickle can be ground in less than 30 minutes, and tests have shown that the sickle cuts better and stands up longer than if ground with a grindstone.

The special wheel for sickles should not be used for other work as it is apt to get out of the proper shape for sickle grinding. At the close of the mowing season, this wheel should be removed from the shaft and stored until again needed. If the wheel gets out of round or the surface irregular, it may be brought back to correct shape with an emery dresser.

If sickle heads become loose and need to be tightened or reriveted, the rivets are placed from the bar side and riveted on the head as shown in Fig. 3. A piece of railroad rail makes a serviceable anvil for this work and for other farm repairs.

A good way to remove a section is to place it in a vise and, with the bar of the sickle resting on one vise jaw as in Fig. 4,

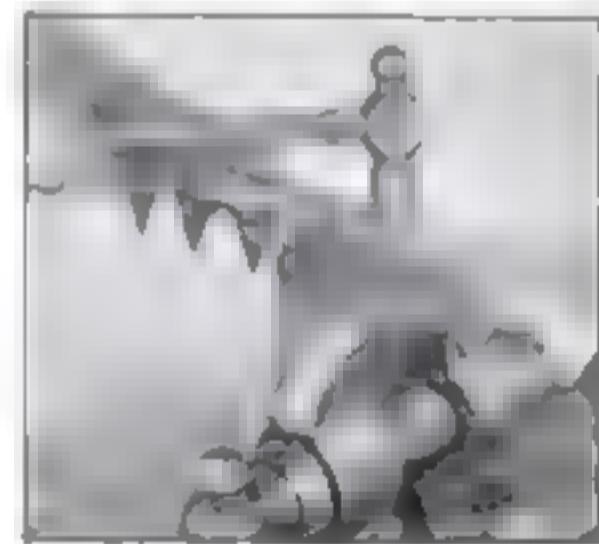


Fig. 3. Removing a section from a sickle bar by heating the rivet with a blowtorch and a chisel.

hit it with a blow torch to heat the rivet in the edge of the section of the bar near the feet. This shears the rivet and the section drops out.

When riveting a section in place the rivet should not be hammered down flat, or the edges will protrude so as to catch and drag the lengthwise of the cutter bar. This increases friction and heat. The small end of a ball peen hammer is used for this work. The blows are directed as shown in Fig. 3, and a smooth, round head is the result.

What farm repairs would you like Mr. Rich to discuss next in this series? Please address your suggestions to the Home Workshop Department.

FIREPROOF COATING FOR WOODEN ASH TRAYS

After making a wooden model on several occasions, I have found that if it were lined with glass or metal it would serve as a fine novelty ash tray. Because of the irregular shape, it was impossible to use glass and impractical to make a regular metal lining. I discovered an inexpensive way of making liners simply by applying high grade iron cement mixed with just enough water to make a stiff putty. Cover the inside of the model with a thin layer. I used this method to line the old well model described in a previous issue (P. S. M., Dec. '31, p. 84).—Harry Sorenson

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RAISING TROPICAL FISH BIG INDUSTRY

(Continued from page 27)

stance here is an aquarium divided into halves by a glass partition. Swimming rapidly back and forth, but separated by the partition, are two identical fish. Each is flesh-colored, each enveloped in what seem to be luxuriant fringes or manes of bright red that resemble some exotic water plant. These make constantly shifting patterns, as the fish tear back and forth. Now and then they stop, glare through the glass at one another or butt their heads and act it. They seem eager to fight.

So they are, for they are two male Siamese fighting fish, who had to be separated to keep them from engaging in death struggle. They are but following nature, since for many years *Betta splendens*, one of the most pugnacious of tropical fish has been bred for battle. He is a hybrid, and his abundant and wavy tail and fin formations are a somewhat art fiscal product. They help make more spectacular the combats in which he loves to engage.

IN SIAM, men train fighting fish like prize-fighters, exhibit them in individual tanks, seeking a challenger. Then, when a match is made, the fight takes place in a large tank, elevated in the center of the crowd. Amid cheers, hoots, and wagers, in a swirl of bright-colored bodies, veil-tails and fins, the fight rages, until the teeth of one have brought death to the other.

The rage for tropical fish has brought this Siamese custom to this country and fish fights have become popular. People are talking of replacing *Betta splendens* with a larger fighter from Guatemala, said to be more vicious.

Here in another tank, is an even rarer tropical fish, the mud springer, found in Africa. It looks like a bullfrog's head on a dragonfly's body. It has neither legs nor feet, but

with powerful pectoral fins, hops over the muddy ground at the water's edge. It digs holes in the shore, and darts out to catch insects flying in the air.

Here, in a near-by tank, is an interesting visitor from Singapore and Sumatra, the Red Rasbora. This is, at the moment, one of the most popular tropical fish in America. About two inches long, its coloring is gorgeous. You may want some for your aquarium. Children delight to watch the female Rasbora swim about until she finds a plant with large leaves. To the underside of the leaves she fastens the eggs she has been carrying.

That trick does more than get rid of the eggs. It hedges them from curious hungry fish who may even include the parents. They have been known to stoop to cannibalism.

Having got your fish into your aquarium, how will you feed them? All sorts of food can be bought at the place where you got the fish, including prepared foods that are a sort of rice-flakes, or that have been treated with ultra-violet rays. Prepared foods are all right, though the best is living food, larvae, tiny insects, and worms.

Don't put more food in the water than the fish can eat. It will simply poison the water. Another don't. Don't try experiments to make tropical fish spawn. If you keep the fish well fed, and the tanks clean, the chances are they will increase and multiply. If they don't, get some new fish. And a final tip: Don't put the aquarium on a window sill especially if the window sill is just over a radiator. An aquarium should have neither extreme heat nor draft. It needs light, but not direct sunlight. If you want to get the most enjoyment from watching your funny pets, the light must strike the aquarium from behind you.

TESTS WITH HOUSEHOLD AMMONIA

(Continued from page 40)

menting with the nitrogen you collect, you will find that it is a very inactive gas. The fact that you can collect it over water shows that it is not particularly soluble. Carefully raise a glowing splinter in water into an inverted bottle of the gas and you will find that the ember is extinguished. Nitrogen is a non-burner, but supports combustion. Further tests will show the gas to be tasteless and odorless.

In fact, nitrogen does not combine readily with many substances and its compounds are easily decomposed. The ease and violence with which most of its compounds break down are well illustrated by two common nitrogen-containing substances—nitro-glycerine and gun cotton.

Ammonia and ammonium salts offer many other interesting and instructive experiments to the home chemist. The hydroxides of many metals, for example, can be formed by adding ammonia water (household ammonia will do) to solutions of the metals. Such solutions as copper sulphate, lead nitrate, iron chloride, iron sulphate, nickel sulphate, cobalt compounds, alum, and magnesium sulphate (Epsom salts) lend themselves well to this experiment.

The hydroxides form as curdy, jelly-like precipitates. In some cases they are so thick that the test tube in which they are made can be inverted without spilling the contents.

In these experiments, it is interesting to note that the precipitates of copper, nickel, and cadmium hydroxides will dissolve when more of the ammonium hydroxide is added to the solution. In the case of the copper sulphate, the resulting liquid will take on a deep azure blue color. If very strong ammonium hydroxide is used in the precipitating and dissolving processes, the blue solution will dis-

solve tiny bits of paper. This particular property has been used in the manufacture of artificial silk.

By adding water to a mixture of ammonium nitrate and zinc dust the experimenter can produce a small ammonia gas flame. As the water is added to the mixture it bubbles and smokes until it finally burns. Care must be taken, however, not to add too much water.

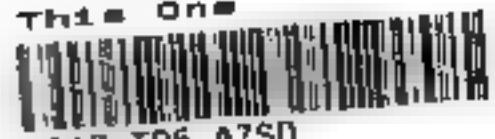
AS a safeguard, the mixture can be placed on the tin cap from a preserve jar and newspaper can be spread on the laboratory table to catch the chemicals should the mixture spatter.

No discussion of ammonia gas would be complete without some mention of its commercial uses. The most important uses of ammonia are as a refrigerating agent and for the preparation of ammonia water. Large quantities of ammonia, however, are also used in the manufacture of sodium carbonate, ammonium salts, and nitric acid.

SNOW EROSION STUDIED

Snow erosion as a menace to wheat farms of the Northwest is being studied by experts of the U. S. Department of Agriculture. It has been found that where snowdrifts collect in the winter, soil is washed away by water from the melted snow when spring thaws set in. Because it is a common practice in the wheatlands to plow the ground in the fall, snowdrift erosion is particularly rapid there, the water easily carrying away the small particles at the top of the furrows. The north side of hills, where the snowdrifts are deepest, are most affected by the erosion. Methods of combating this type of soil thief are being worked out by the government investigators.

This One



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UNCLE SAM'S EXHIBITS AT WORLD'S FAIR

(Continued from page 11)

States outlined by lights that flare or fade under switch control. The leading countries with which Uncle Sam trades are designated by colored lights. Tiny miniatures of freighters and ocean greyhounds, moved by electric motors, pass along the established ocean lanes between this country and foreign ports.

Models of battleships, cruisers, and destroyers patrol the ocean, blockade strategic harbors, and go through the routine of war time precautions at sea. The animated spectacle, operating on a controlled time sequence, reproduces the activity of the Navy both in peace and war. For the first time in history, these stirring nautical maneuvers are fully reproduced in miniature.

Another naval exhibit emphasizes the changes in design and construction that have taken place during the 150-odd years that have elapsed since John Paul Jones fought in sailing ships. Six models of sailing ships cruise a tiny sea, side by side with half a dozen modern battleships. Seaplane and plane carrier models, a miniature Akron, cutaway models of the latest marine engines, the development in ship propulsion and improvements in propellers, naval weapons, bombs, projectiles, airplane appliances, and safety devices complete the display.

A REALISTIC model will illustrate the damage done by vast swarms of grasshoppers in a field of corn. An artificial grasshopper, thirty inches long, is mounted in the foreground and an illustrated text describes the insect's life cycle and tells how the pest can be controlled.

A full-scale reproduction of the interior of a modern ocean liner, equipped with the instruments and apparatus of the wheel room, offers a striking contrast to the model of the foredeck of a schooner of the type in use at the time of the Mexican War.

An exhibit by the Census Bureau of the Department of Commerce consists of a large statistical chart which signals the increases in our population that occur at twenty-second intervals during a selected day. In addition, lights flash on and off to record the fluctuations in births and deaths, and in emigration and immigration. A battery of tabulating equipment will show how the census data are handled, counted, sorted, and tabulated by machinery.

Puppet figures will re-enact the dramatic rescue work of the Bureau of Mines experts in mine disasters and demonstrate how first aid treatment is given to the injured.

Airports and the network of commercial airways will be shown on a large electric back-

ground map. A full-sized radio beacon will be operated by remote control, and nearby the teletype machine, now used by the Weather Bureau and Department of Commerce in sending out flying weather maps, will be in operation.

UNCLE SAM'S hundreds of exhibits will give a clear-cut idea of the far-flung activities of his scientists. There will be, for instance, a demonstration of finger printing as used in crime detection. A tiny reproduction of Old Faithful will show how a geyser works. In miniature, the visitor will see a modern live stock farm in successful operation. Models of coal and metal mines, of oil fields, of storage dams, and hydro-electric plants will supply a graphic picture of these giant industries.

Paintings and models will show transportation methods in Alaska, salmon fishing, and gold mining in the frozen North, the cabin of an Alaskan trapper, and the garments he makes from reindeer skin.

The accurate and world-wide methods of collecting and reporting crop conditions will be shown, along with the work of experts in solving problems for the dairymen of America. In an aquarium will be seen specimens of all our commercially valuable fish and the manner in which they are killed and packed.

A mysterious old Mayan temple in the Yucatan jungle has been recreated as headquarters of the national exhibit of the Indians. Models illustrate the tribal life and surroundings of the Indians of the woodlands as well as the buffalo-hunters of the plains. Wigwams, tepees of bark and skin, adobe homes of the Pueblo dwellers, the earth-covered hogans of the Navajos are all faithfully reproduced. Another display depicts the arts and crafts of civilized redmen, their success in the trades and agriculture and their present self-supporting ability.

The bill authorizing the participation of the Federal Government in the Century of Progress exposition placed the work of creating and assembling the exhibits in charge of the Secretaries of Commerce, Agriculture, and State. Harry S. New, former postmaster-general, was appointed commissioner with Colonel W. B. Cousey as assistant commissioner. Congress appropriated \$1,000,000 to finance the national show. Approximately \$100,000 was expended on the design and construction of the temporary Federal Building on the exhibition grounds while about \$500,000 has been used in planning and building the exhibits that show what Uncle Sam does for the general public, and how he does it.

AMAZING SKILL WITH STRINGS GIVES LIFE TO MOST FAMOUS PUPPETS

(Continued from page 22)

is carried together with more than a ton of extra heads, legs, arms, cloth, and wire. Expert doll surgeons make rapid repairs upon injured actors while the company is on tour.

When the troupe of marionettes moves from one city to another, a hundred packing cases are required to hold the equipment, the little actors, and their specially-designed costumes. Each puppet is packed in its own cloth bag. Each wig and head goes in its individual con-

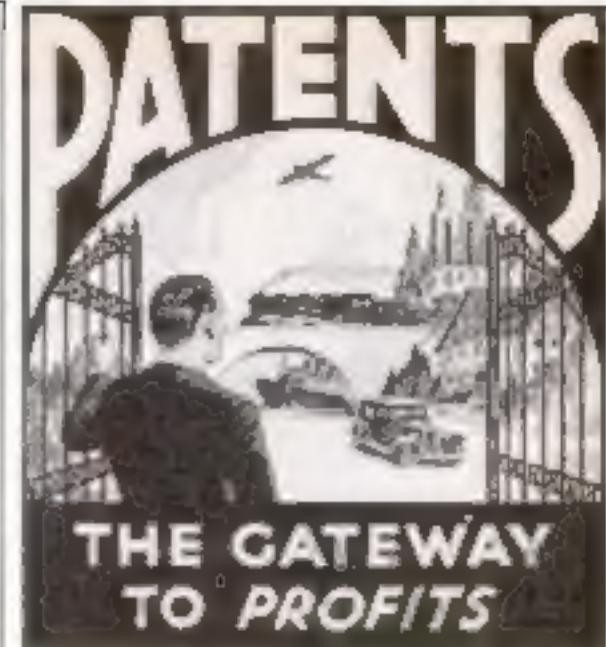
tainer. And the costumes for the 800 members of the cast travel in large cases of special construction.

Vittorio Podrecca, the organizer of "The Theater of the Little Ones," began assembling this amazing company of puppets in 1916. Since then, he has taken his troupe of animated dolls around the world. During the present tour, they will visit the main cities of the United States.

TONS OF CANDLES TO LIGHT HOMES

Seven tons of candles a year, an English electrical engineer has computed, would be required to provide the same amount of illumination in the average small house that is now obtained from electric bulbs. With candles at ten cents a pound, he figures the average weekly bill for candlelight would

be twenty-two dollars in winter and eight dollars and forty cents in summer! If candles were used to provide the same illumination now derived from electric equipment on subway trains, he reports, two tons of candles would have to be loaded on each train each morning.



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Gland Operations Effect Marvelous Cures

(Continued from page 16)

country, similar operations have since been performed with encouraging results.

Below the pancreas are the two adrenal glands, perched like a cocked hat, one on the upper pole of each kidney. Hardly bigger than large beans, they secrete one of the most powerful drugs known to man, adrenalin. One part adrenalin in 330,000,000 parts water can still be detected in the laboratory. Normally, the proportion of adrenalin in the blood is about one part in one billion. It is the fighting drug, released into the bloodstream by emotions of anger and fear. It speeds up the heart and contracts the blood-vessels near the skin, thus increasing the supply to vital organs. In medicine, adrenalin is sometimes employed to stop hemorrhages and, under dramatic circumstances such as were described in an earlier article of this series, to bring back to life patients whose hearts have stopped on the operating table.

NOT long ago, three American scientists discovered adrenalin in the warts on the heads of five species of toads. Heretofore, the adrenalin used in hospitals was extracted from the glands of cattle, hundreds being required to produce enough for the people who needed it. It is predicted that special toad-farms may be established in the future for the production of this valuable drug.

When anything upsets the proper functioning of the adrenal glands in the human system, the body undergoes strange and startling changes. Women, for instance, grow beards and develop bass voices. One of the most remarkable operations I remember stopped a pair of runaway adrenal glands that were increasing the weight of a twenty-three-year-old girl 125 pounds a year.

She weighed 335 pounds when she came to Dr. Harry Koster, of Brooklyn, N. Y., in 1929. Her weight had almost tripled in the preceding years. He made an examination and discovered the cause was over-active adrenal glands. On the operating table, he made an incision through the thick muscles of the back and exposed the right kidney. The adrenal gland attached to it was three times its normal size. He removed it entirely and closed the wound.

The result was that the girl began to lose the abnormal fat as rapidly as it had developed. In the first month, without any dieting, she lost twenty-five pounds. During the rest of the year, she reduced at the rate of about fifteen pounds a month and in the end became normal size again. In addition, her health was greatly benefited.

BY SEVERING the nerve leading from the brain to the adrenals, Dr. George W. Crile, famous Cleveland, Ohio, surgeon, has recently been able to achieve astonishing results. Stomach and intestinal ulcers were cleared up, exophthalmic goiters were made to subside, and high-strung, nervous people were calmed down through this relatively-simple operation.

Few branches of surgery have made greater progress in recent years than that which deals with the pituitary, a gland about the size of the tip of your little finger which is locked in a bony box at the base of the brain near the center of the skull. It would seem to be the most difficult place in the world to reach with instruments. Yet, in emergencies, skillful surgeons, today, remove the gland entirely.

An inactive pituitary in childhood makes a dwarf; an over-active one produces a giant. When Macgrath, the famous Irish giant, died, a post-mortem revealed that he had a pituitary gland as big as a hen's egg. Dinosaurs, a study of their skulls has indicated, possessed enormous pituitary glands. Sometimes, the

pituitary alters the speed with which it manufactures the chemical it secretes into the blood with the result that people grow in spurts. The most remarkable instance of a pituitary suddenly speeding up its action is the case of Geoffrey Hudson, the English dwarf.

When he was eight years old he was a little more than twelve inches high. He remained about a foot and a half tall until he was thirty. At that age he was captured by Turkish pirates and the privations he suffered are thought to have affected the action of his pituitary gland. For, he suddenly began to grow, more than doubling his height. He attained three feet nine inches before the spurt stopped.

When the pituitary is affected during adult life, a rare disease known as acromegaly sometimes results. The hands and feet of the afflicted person begin to grow. Enormous gloves and shoes have to be made to order. At the same time the bones of the face enlarge, the cheekbones and forehead bulging and the lower jaw protruding. A delicate operation, reaching the pituitary, is necessary to halt the disease.

EVEN more delicate are operations upon the pineal gland, buried deep in the brain stem near the base of the skull. When a tumor forms upon this gland, bizarre symptoms result. The most striking is precocious sexual development. I recall one case in which a boy six years old was as fully developed as a seventeen-year-old youth as the result of such a pineal gland tumor. Unless the skill of the surgeon can remove such tumors, their pressure upon the internal fluids of the brain causes headache, blindness, and death.

The sex glands, both in men and women, secrete a hormone that is responsible for the traits of manhood and womanhood respectively. When the hormones formed by these glands are lacking, one is apt to become prematurely old. This is the fact behind various operations that have been performed in the hope of rejuvenating prematurely old people.

Most famous of all the surgeons who have

performed such operations is Dr. Eugen Steinach, of Vienna, Austria. His technique consists in tying off the duct leading from the male gland, thus permitting the hormone-secreting parts of the gland to flourish and increase the amount of the chemical poured into the bloodstream.

Other surgeons, including the French scientist, Dr. Serge Voronoff, follow the practice of transplanting human or animal glands. Only last year a rejuvenation miracle was accomplished in a hospital in Helbeis, Egypt, by two Egyptian doctors. They transplanted a gland from a young man of twenty-five to an elderly man of ninety. A painful condition required that one of the younger man's glands be removed. The surgeon grafted it under the skin of the senile patient who was very weak and trembled constantly as aged people are quite likely to do.

THE graft took in a week's time and a most amazing change came over the old man. The wrinkles of his face were greatly diminished. The hair on his scalp became thicker. The trembling stopped. His appearance was so altered that friends failed to recognize him. Moreover, his mind became more alert and he felt more masculine in every way.

After a successful operation of this kind, the patient looks and feels younger. He enjoys life more. But such rejuvenation does not prolong life nor does it diminish the hardening of the arteries that accompanies old age.

Recently, Dr. H. Lyons Hunt, of New York City, has been relieving nervous and sensible women, suffering from a deficiency of their sex glands, by grafting in glands obtained from freshly-slaughtered sheep.

An astonishing operation, which enabled a woman to become a mother after her sex glands had been removed, is on record in an eastern hospital. Because of extensive pelvic inflammation, it was necessary to remove the glands and their tubes. As both the woman and her husband earnestly desired a child, the surgeon, Dr. William Seaman Bainbridge, carefully examined the organs he had removed in the hope of finding a morsel of healthy gland.

His search was rewarded. Discovering a piece hardly larger than the end of a little finger, he grafted it on the stump of one of the tubes. A year and a half later, the woman bore a healthy child.

Almost surpassing belief is another case reported by Dr. R. T. Morris, of the Post-Graduate Hospital, New York City. A woman whose sex glands had been removed bore a child through the agency of another woman's gland grafted inside her abdomen!

ON THE day when Dr. Morris operated upon her to remove the diseased organs, another surgeon at the Post-Graduate Hospital was operating upon another woman. A painful condition made it necessary to remove one of her glands and he offered it to Dr. Morris. The surgeon accepted it and at the end of his operation grafted a piece of this healthy gland, a little larger than a postage stamp, into the ligament which normally holds the female gland. Four and a half years later, the woman gave birth to a healthy girl baby weighing seven and a half pounds.

Such miracles of the operating room are growing more common each year. Researches are probing deeper into the mysteries of the human glands. Yet, in spite of the wonders already accomplished, surgeons know they are just beginning. No other branch of medicine offers more important or more dramatic possibilities for the future.



This piece of apparatus, looking like a horn upon which a giant might play, is really part of a water turbine for a hydroelectric plant. Water, rushing through it, spins the blades. It is 17 feet high and weighs 77,000 pounds.



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